FIG. 1

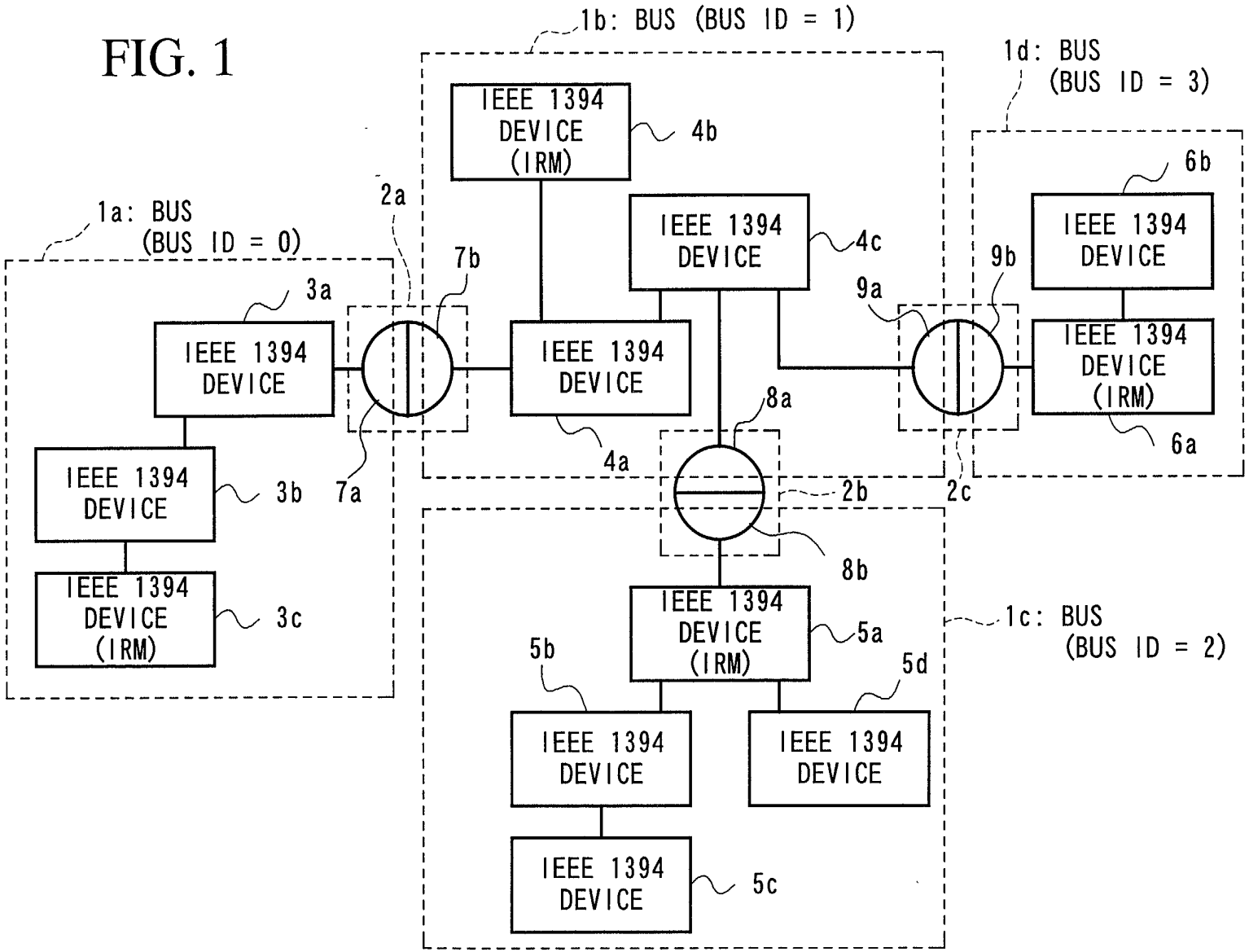
1b: BUS (BUS ID = 1)
1d: BUS (BUS ID = 3)
1a: BUS (BUS ID = 0)
1c: BUS (BUS ID = 2)
IEEE 1394 DEVICE (IRM)
4b
IEEE 1394 DEVICE
4c
IEEE 1394 DEVICE
3a
IEEE 1394 DEVICE
4a
IEEE 1394 DEVICE
3b
IEEE 1394 DEVICE (IRM)
3c
IEEE 1394 DEVICE
6b
IEEE 1394 DEVICE (IRM)
6a
IEEE 1394 DEVICE (IRM)
5a
IEEE 1394 DEVICE
5b
IEEE 1394 DEVICE
5d
IEEE 1394 DEVICE
5c
2a
2b
2c
7a
7b
8a
8b
9a
9b

FIG. 2

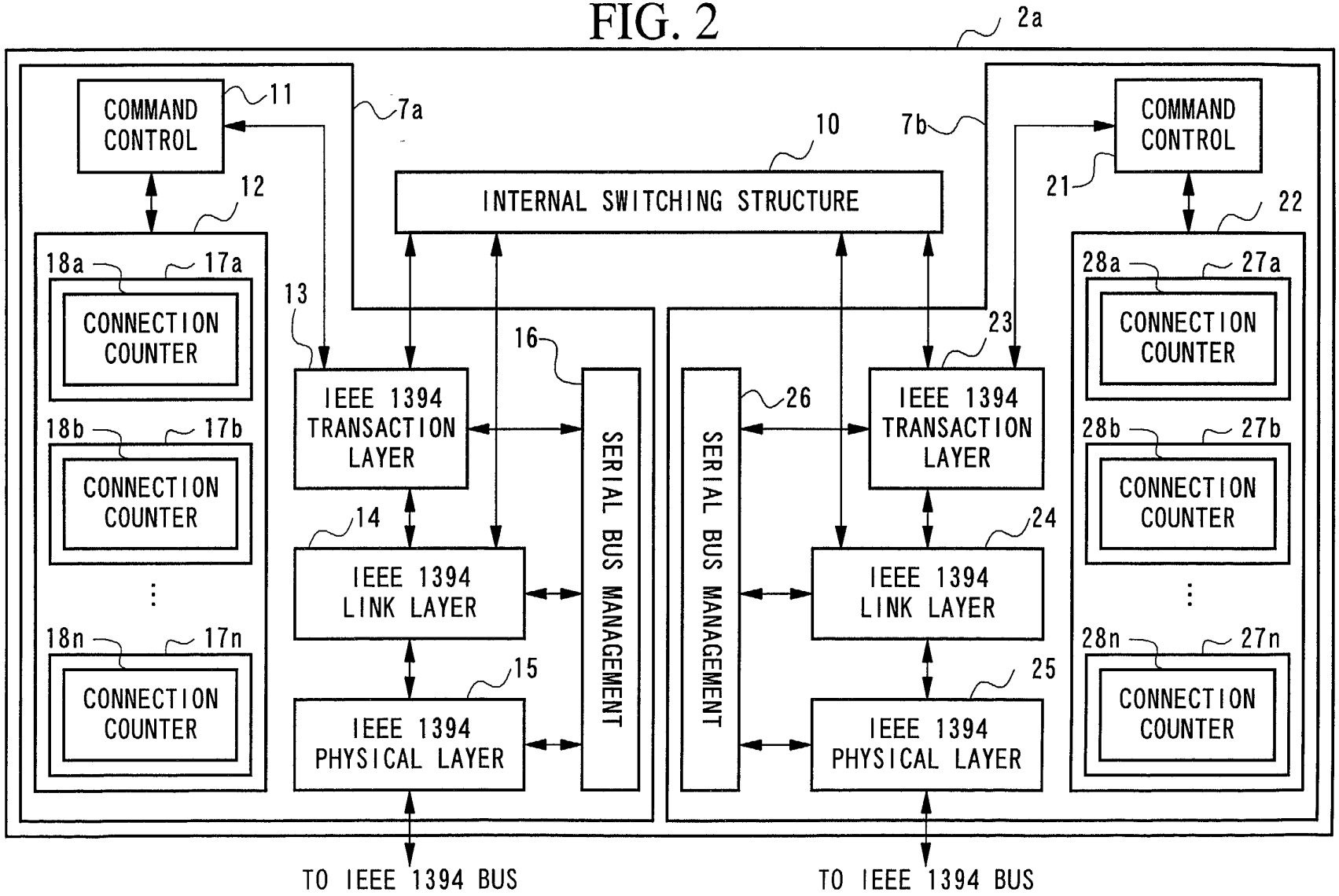
2a
COMMAND CONTROL
11
7a
10
7b
COMMAND CONTROL
12
INTERNAL SWITCHING STRUCTURE
21
22
18a
17a
CONNECTION COUNTER
13
16
23
28a
27a
CONNECTION COUNTER
IEEE 1394 TRANSACTION LAYER
SERIAL BUS MANAGEMENT
26
IEEE 1394 TRANSACTION LAYER
18b
17b
CONNECTION COUNTER
14
24
28b
27b
CONNECTION COUNTER
IEEE 1394 LINK LAYER
SERIAL BUS MANAGEMENT
IEEE 1394 LINK LAYER
18n
17n
CONNECTION COUNTER
15
25
28n
27n
CONNECTION COUNTER
IEEE 1394 PHYSICAL LAYER
IEEE 1394 PHYSICAL LAYER
TO IEEE 1394 BUS
TO IEEE 1394 BUS

FIG. 3

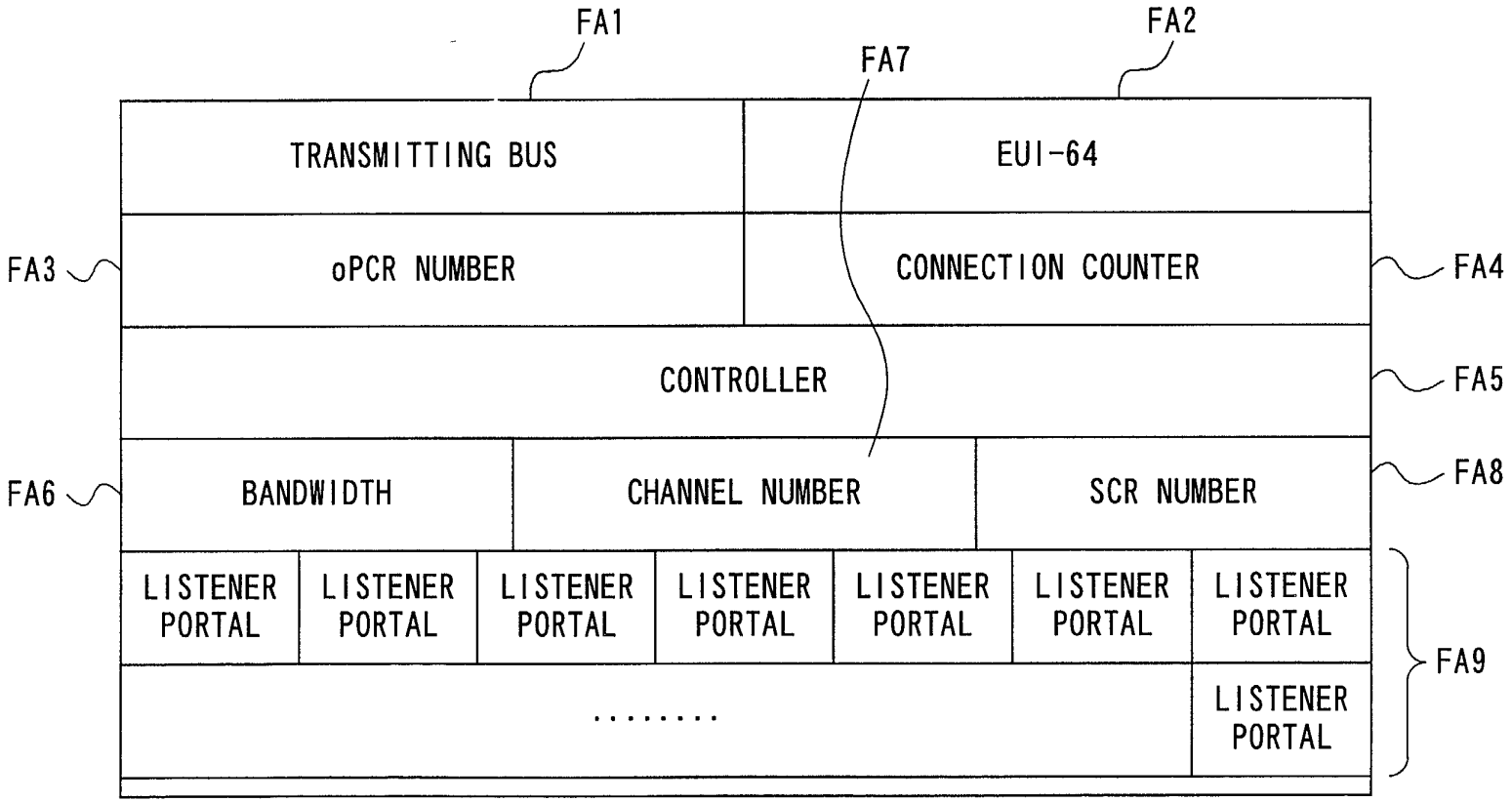
FA1
FA2
FA7
TRANSMITTING BUS
EUI-64
FA3
oPCR NUMBER
CONNECTION COUNTER
FA4
CONTROLLER
FA5
FA6
BANDWIDTH
CHANNEL NUMBER
SCR NUMBER
FA8
LISTENER PORTAL
LISTENER PORTAL
LISTENER PORTAL
LISTENER PORTAL
LISTENER PORTAL
LISTENER PORTAL
LISTENER PORTAL
.....
LISTENER PORTAL
FA9

FIG. 4

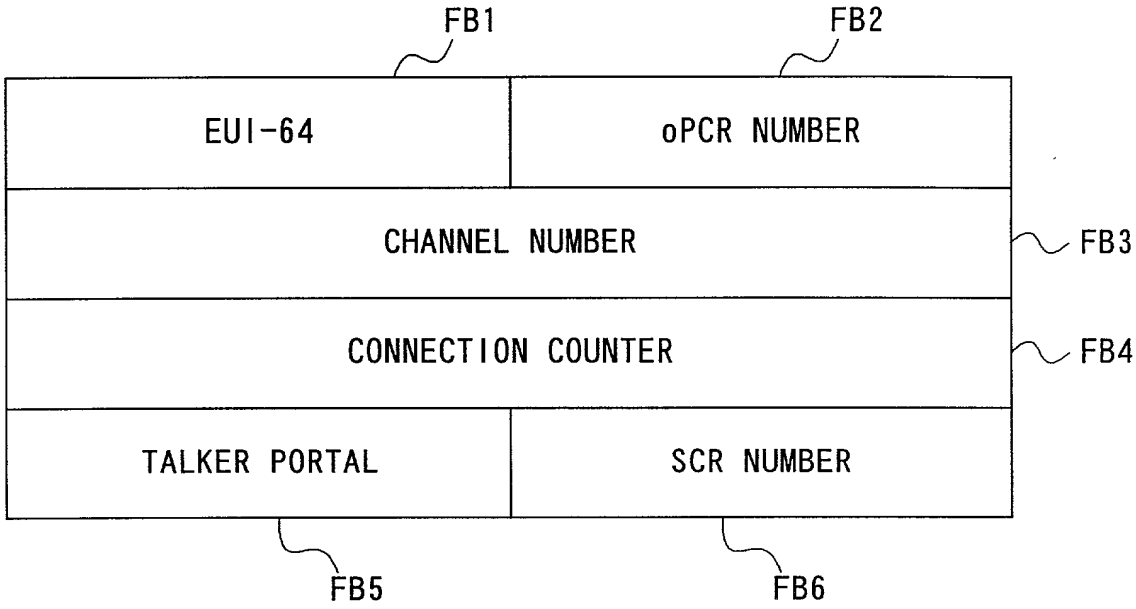
FB1
FB2
EUI-64
oPCR NUMBER
CHANNEL NUMBER
FB3
CONNECTION COUNTER
FB4
TALKER PORTAL
SCR NUMBER
FB5
FB6

FIG. 5

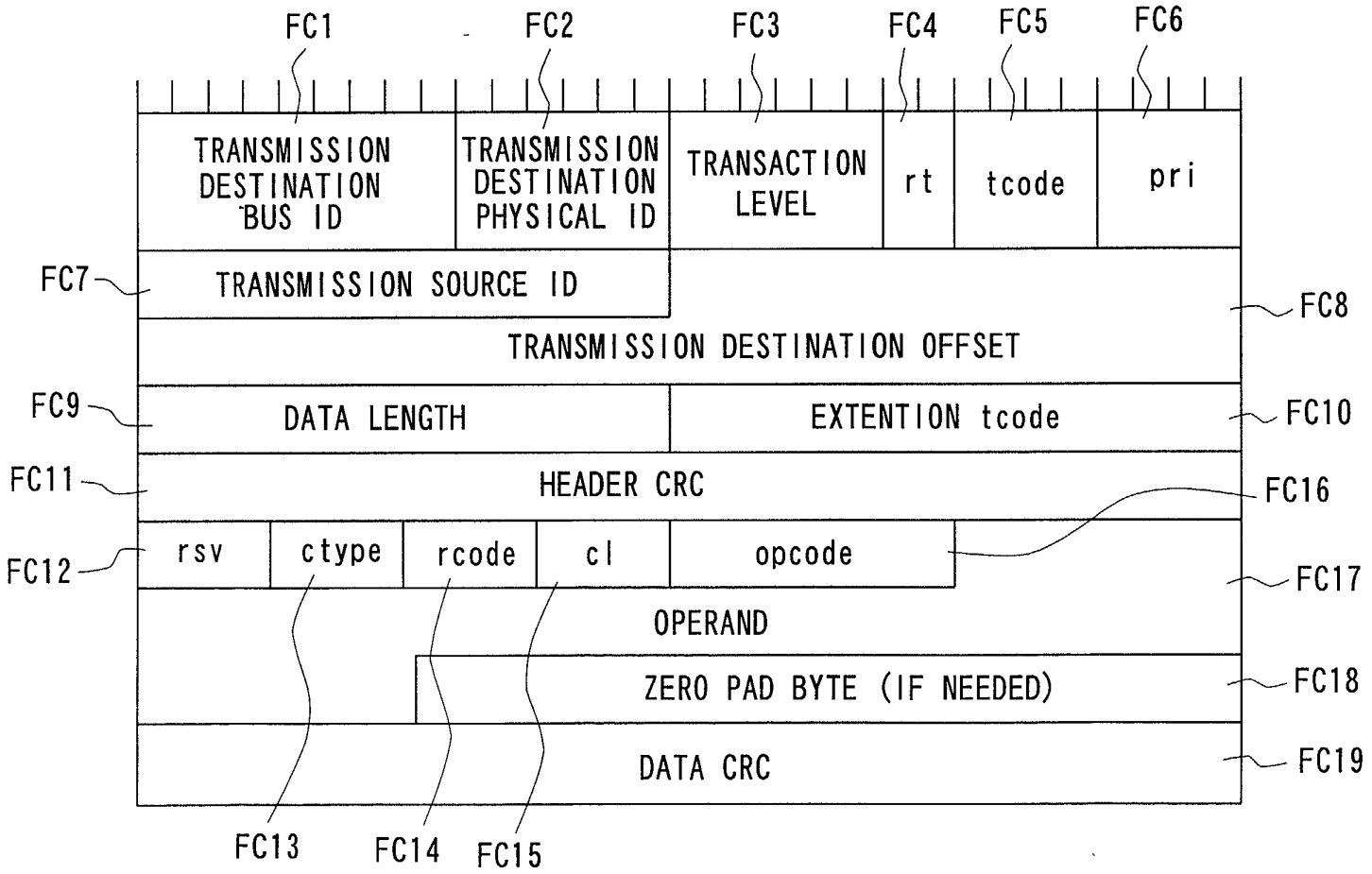
FC1
FC2
FC3
FC4
FC5
FC6
TRANSMISSION DESTINATION BUS ID
TRANSMISSION DESTINATION PHYSICAL ID
TRANSACTION LEVEL
rt
tcode
pri
FC7
TRANSMISSION SOURCE ID
FC8
TRANSMISSION DESTINATION OFFSET
FC9
DATA LENGTH
EXTENTION tcode
FC10
FC11
HEADER CRC
FC16
FC12
rsv
ctype
rcode
cl
opcode
FC17
OPERAND
ZERO PAD BYTE (IF NEEDED)
FC18
DATA CRC
FC19
FC13
FC14
FC15

FIG. 6

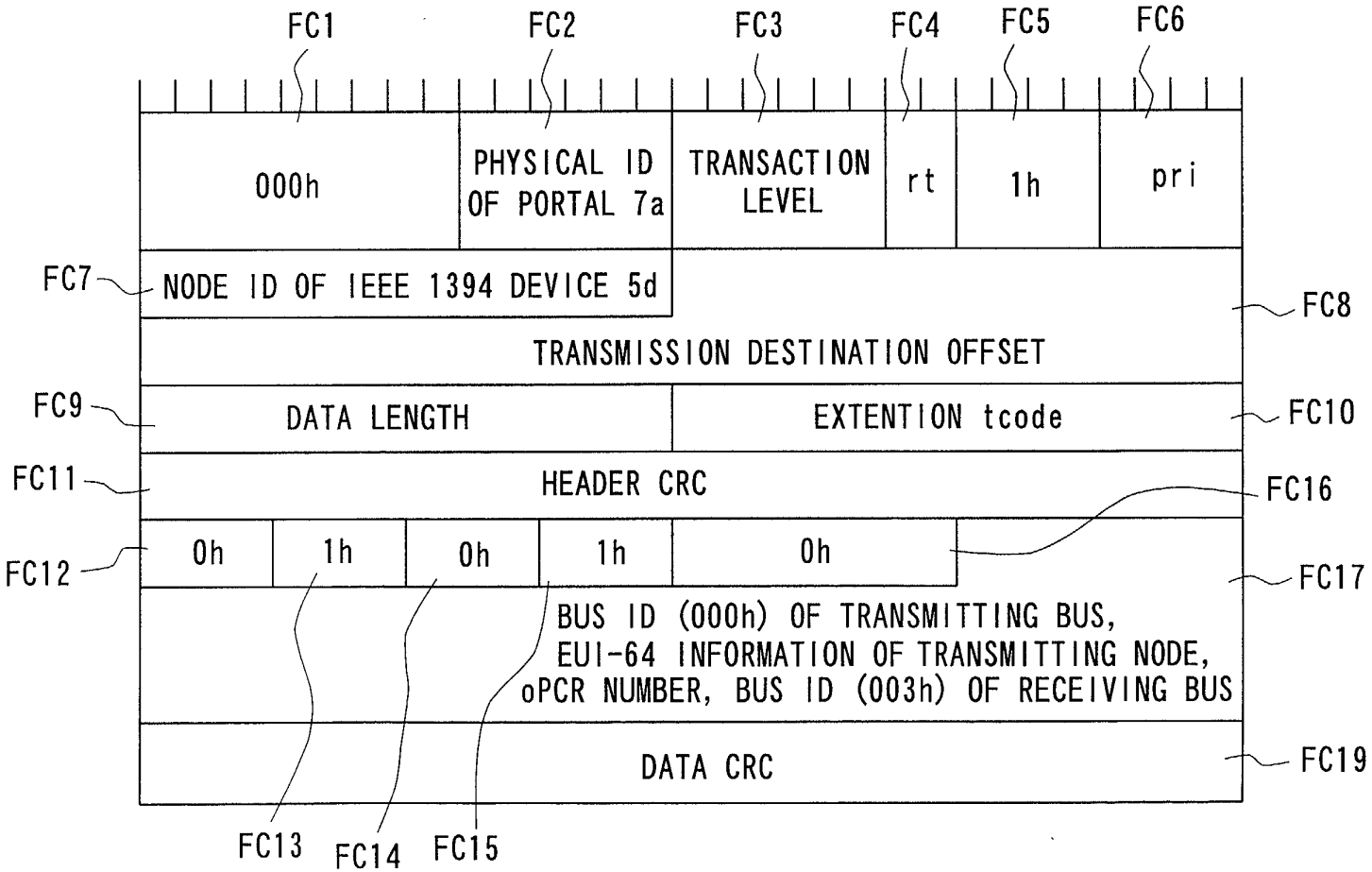
FC1
FC2
FC3
FC4
FC5
FC6
000h
PHYSICAL ID OF PORTAL 7a
TRANSACTION LEVEL
rt
1h
pri
FC7
NODE ID OF IEEE 1394 DEVICE 5d
FC8
TRANSMISSION DESTINATION OFFSET
FC9
DATA LENGTH
EXTENTION tcode
FC10
FC11
HEADER CRC
FC16
FC12
0h
1h
0h
1h
0h
FC17
BUS ID (000h) OF TRANSMITTING BUS,
EUI-64 INFORMATION OF TRANSMITTING NODE,
oPCR NUMBER, BUS ID (003h) OF RECEIVING BUS
DATA CRC
FC19
FC13
FC14
FC15

FIG. 7

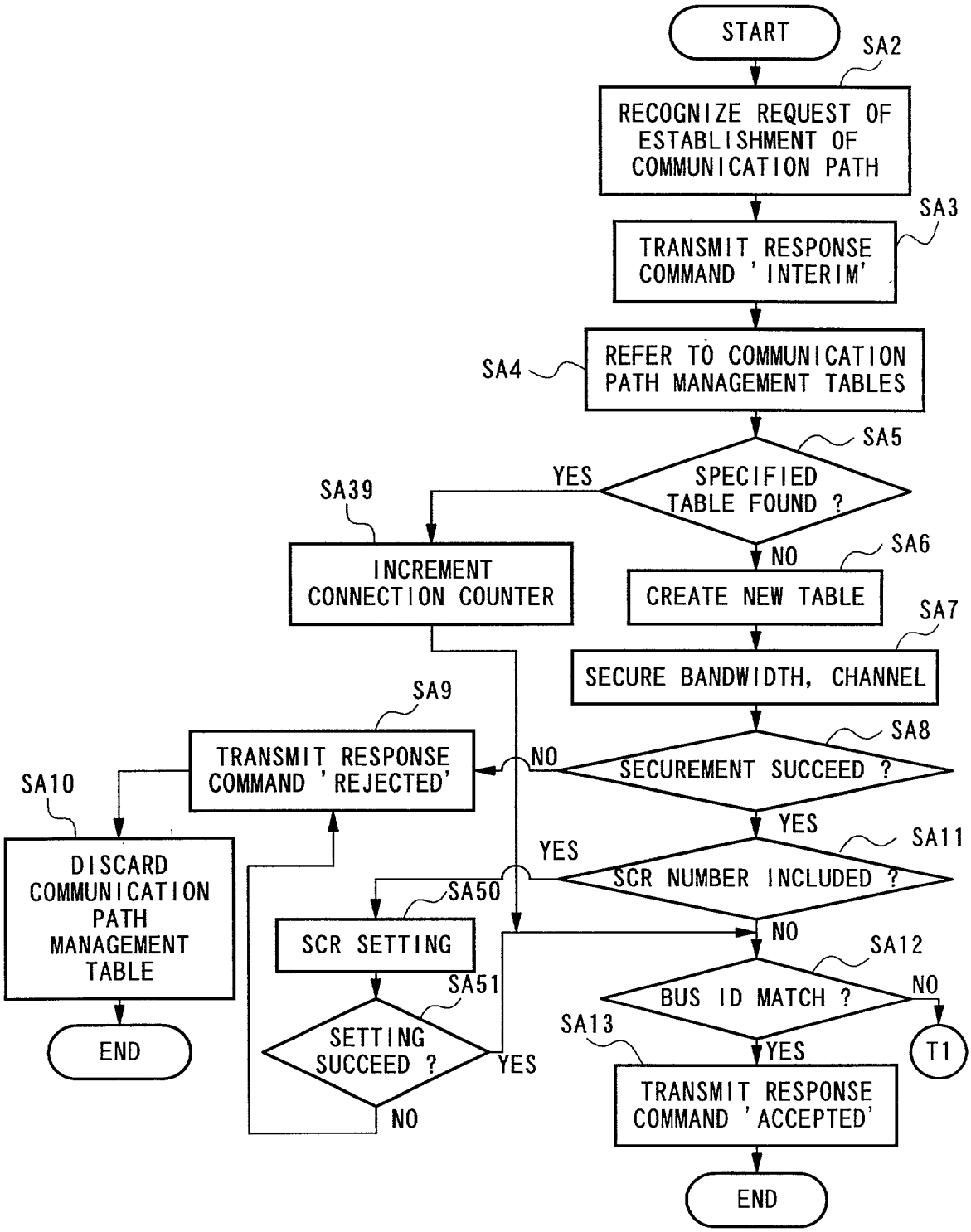
START
SA2
RECOGNIZE REQUEST OF ESTABLISHMENT OF COMMUNICATION PATH
SA3
TRANSMIT RESPONSE COMMAND 'INTERIM'
SA4
REFER TO COMMUNICATION PATH MANAGEMENT TABLES
SA5
SPECIFIED TABLE FOUND ?
YES
SA39
INCREMENT CONNECTION COUNTER
NO
SA6
CREATE NEW TABLE
SA7
SECURE BANDWIDTH, CHANNEL
SA8
SECUREMENT SUCCEED ?
NO
SA9
TRANSMIT RESPONSE COMMAND 'REJECTED'
SA10
DISCARD COMMUNICATION PATH MANAGEMENT TABLE
END
YES
SA11
SCR NUMBER INCLUDED ?
YES
SA50
SCR SETTING
SA51
SETTING SUCCEED ?
YES
NO
NO
SA12
BUS ID MATCH ?
NO
T1
SA13
YES
TRANSMIT RESPONSE COMMAND 'ACCEPTED'
END

FIG. 8

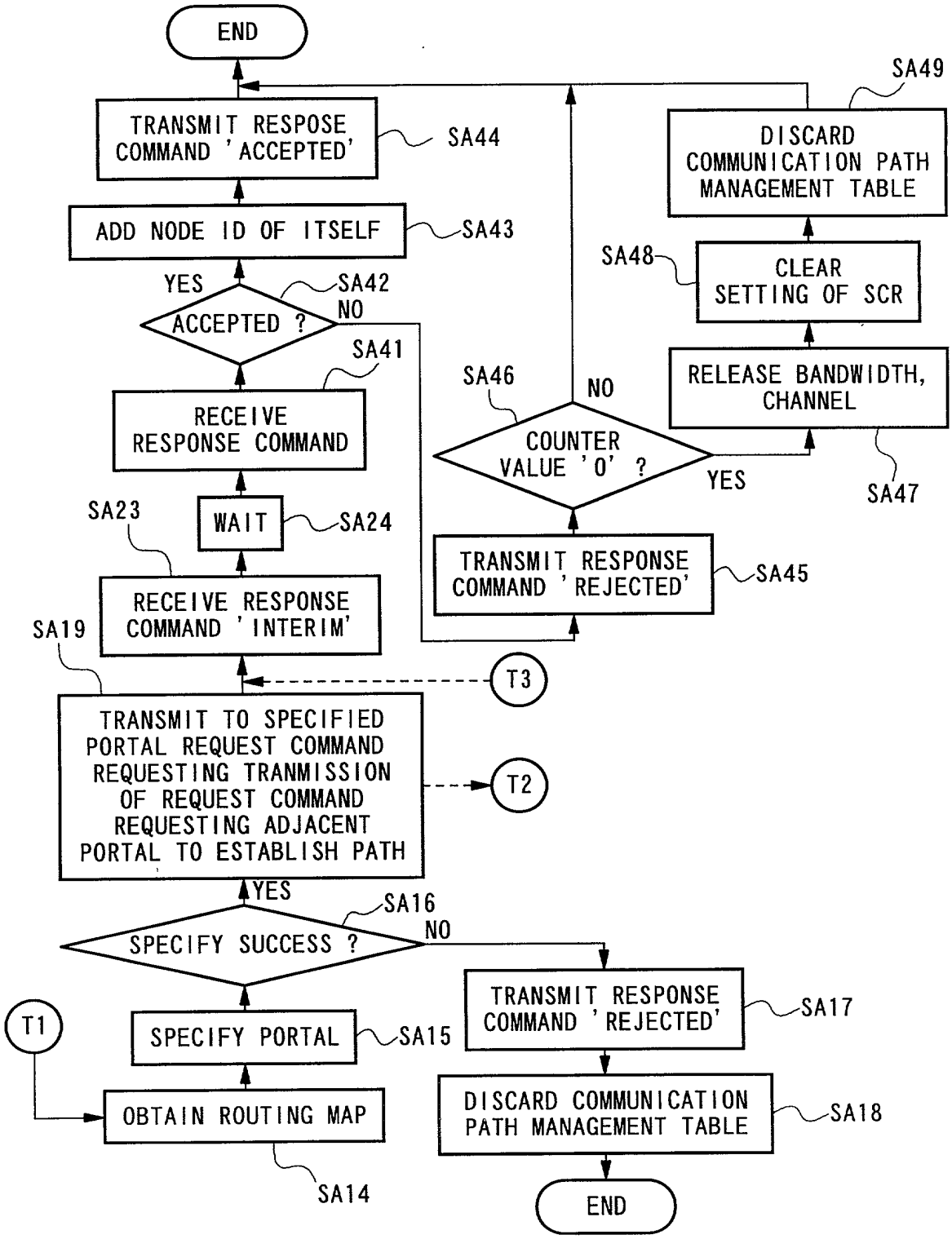
END
TRANSMIT RESPOSE COMMAND 'ACCEPTED'
SA44
ADD NODE ID OF ITSELF
SA43
YES
SA42
ACCEPTED ?
NO
SA41
RECEIVE RESPONSE COMMAND
SA23
WAIT
SA24
RECEIVE RESPONSE COMMAND 'INTERIM'
SA19
T3
TRANSMIT TO SPECIFIED PORTAL REQUEST COMMAND REQUESTING TRANMISSION OF REQUEST COMMAND REQUESTING ADJACENT PORTAL TO ESTABLISH PATH
T2
YES
SA16
SPECIFY SUCCESS ?
NO
T1
SPECIFY PORTAL
SA15
OBTAIN ROUTING MAP
SA14
TRANSMIT RESPONSE COMMAND 'REJECTED'
SA17
DISCARD COMMUNICATION PATH MANAGEMENT TABLE
SA18
END
SA49
DISCARD COMMUNICATION PATH MANAGEMENT TABLE
SA48
CLEAR SETTING OF SCR
RELEASE BANDWIDTH, CHANNEL
SA47
SA46
NO
COUNTER VALUE '0' ?
YES
TRANSMIT RESPONSE COMMAND 'REJECTED'
SA45

FIG. 9

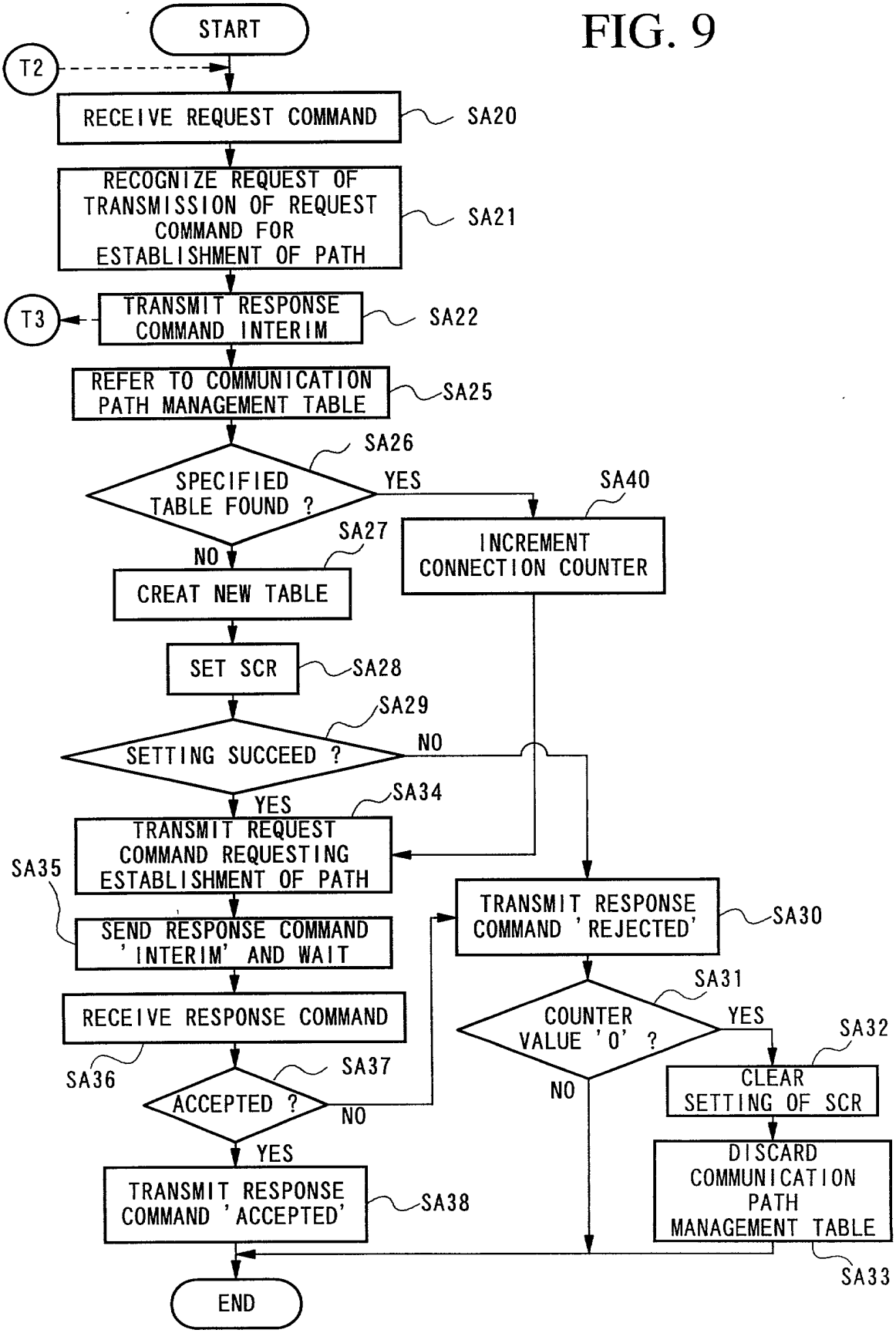
START
T2
RECEIVE REQUEST COMMAND
SA20
RECOGNIZE REQUEST OF TRANSMISSION OF REQUEST COMMAND FOR ESTABLISHMENT OF PATH
SA21
T3
TRANSMIT RESPONSE COMMAND INTERIM
SA22
REFER TO COMMUNICATION PATH MANAGEMENT TABLE
SA25
SA26
SPECIFIED TABLE FOUND ?
YES
SA40
INCREMENT CONNECTION COUNTER
NO
SA27
CREAT NEW TABLE
SET SCR
SA28
SA29
SETTING SUCCEED ?
NO
YES
SA34
TRANSMIT REQUEST COMMAND REQUESTING ESTABLISHMENT OF PATH
SA35
SEND RESPONSE COMMAND 'INTERIM' AND WAIT
RECEIVE RESPONSE COMMAND
SA36
SA37
ACCEPTED ?
NO
YES
TRANSMIT RESPONSE COMMAND 'ACCEPTED'
SA38
TRANSMIT RESPONSE COMMAND 'REJECTED'
SA30
SA31
COUNTER VALUE '0' ?
YES
SA32
NO
CLEAR SETTING OF SCR
DISCARD COMMUNICATION PATH MANAGEMENT TABLE
SA33
END

FIG. 10

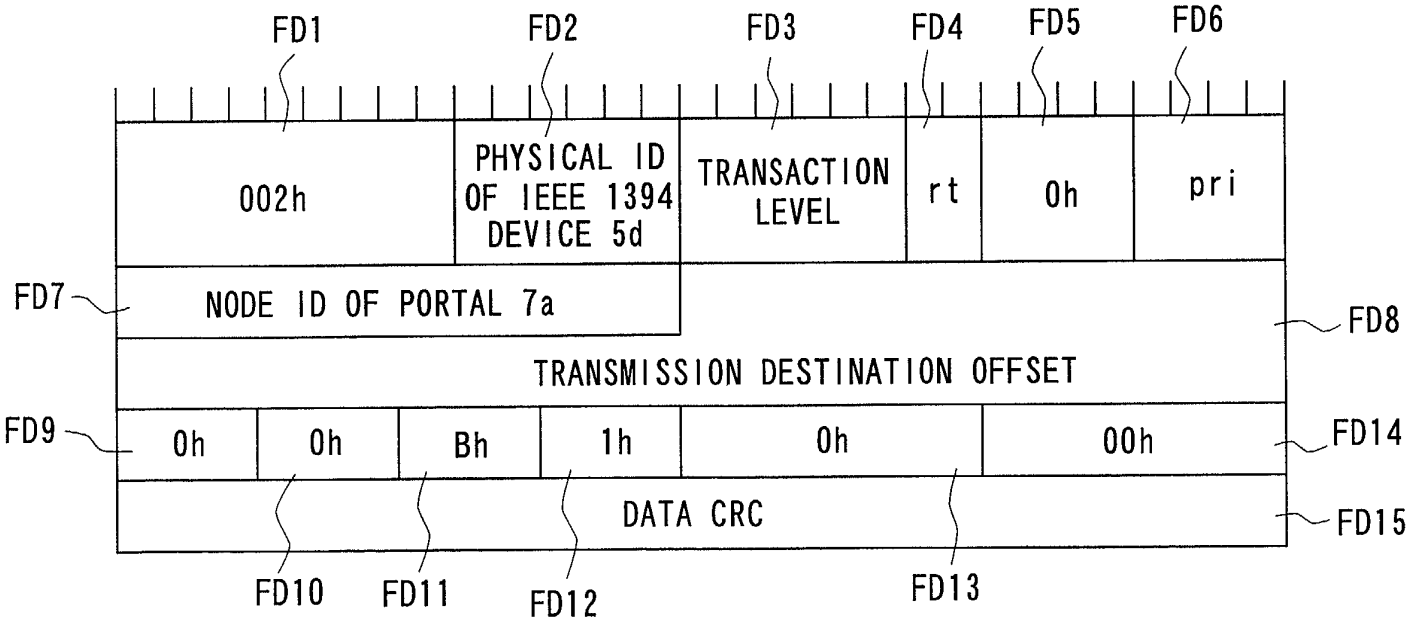
FD1
FD2
FD3
FD4
FD5
FD6
002h
PHYSICAL ID OF IEEE 1394 DEVICE 5d
TRANSACTION LEVEL
rt
0h
pri
FD7
NODE ID OF PORTAL 7a
FD8
TRANSMISSION DESTINATION OFFSET
FD9
0h
0h
Bh
1h
0h
00h
FD14
DATA CRC
FD15
FD10
FD11
FD12
FD13

FIG. 11

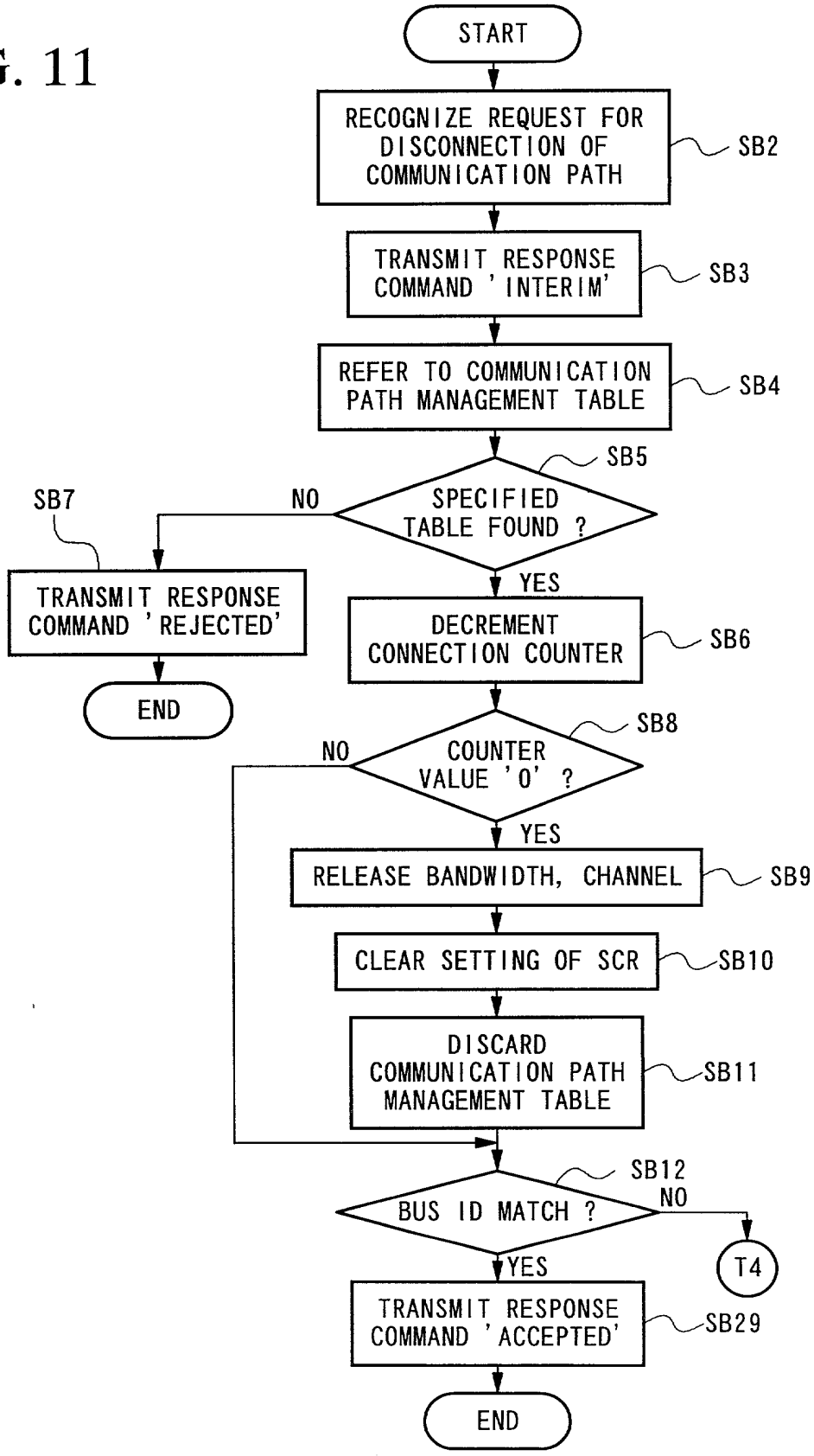
START
RECOGNIZE REQUEST FOR DISCONNECTION OF COMMUNICATION PATH
SB2
TRANSMIT RESPONSE COMMAND 'INTERIM'
SB3
REFER TO COMMUNICATION PATH MANAGEMENT TABLE
SB4
SB5
SPECIFIED TABLE FOUND ?
NO
SB7
YES
TRANSMIT RESPONSE COMMAND 'REJECTED'
END
DECREMENT CONNECTION COUNTER
SB6
SB8
COUNTER VALUE '0' ?
NO
YES
RELEASE BANDWIDTH, CHANNEL
SB9
CLEAR SETTING OF SCR
SB10
DISCARD COMMUNICATION PATH MANAGEMENT TABLE
SB11
SB12
BUS ID MATCH ?
NO
YES
T4
TRANSMIT RESPONSE COMMAND 'ACCEPTED'
SB29
END

FIG. 12

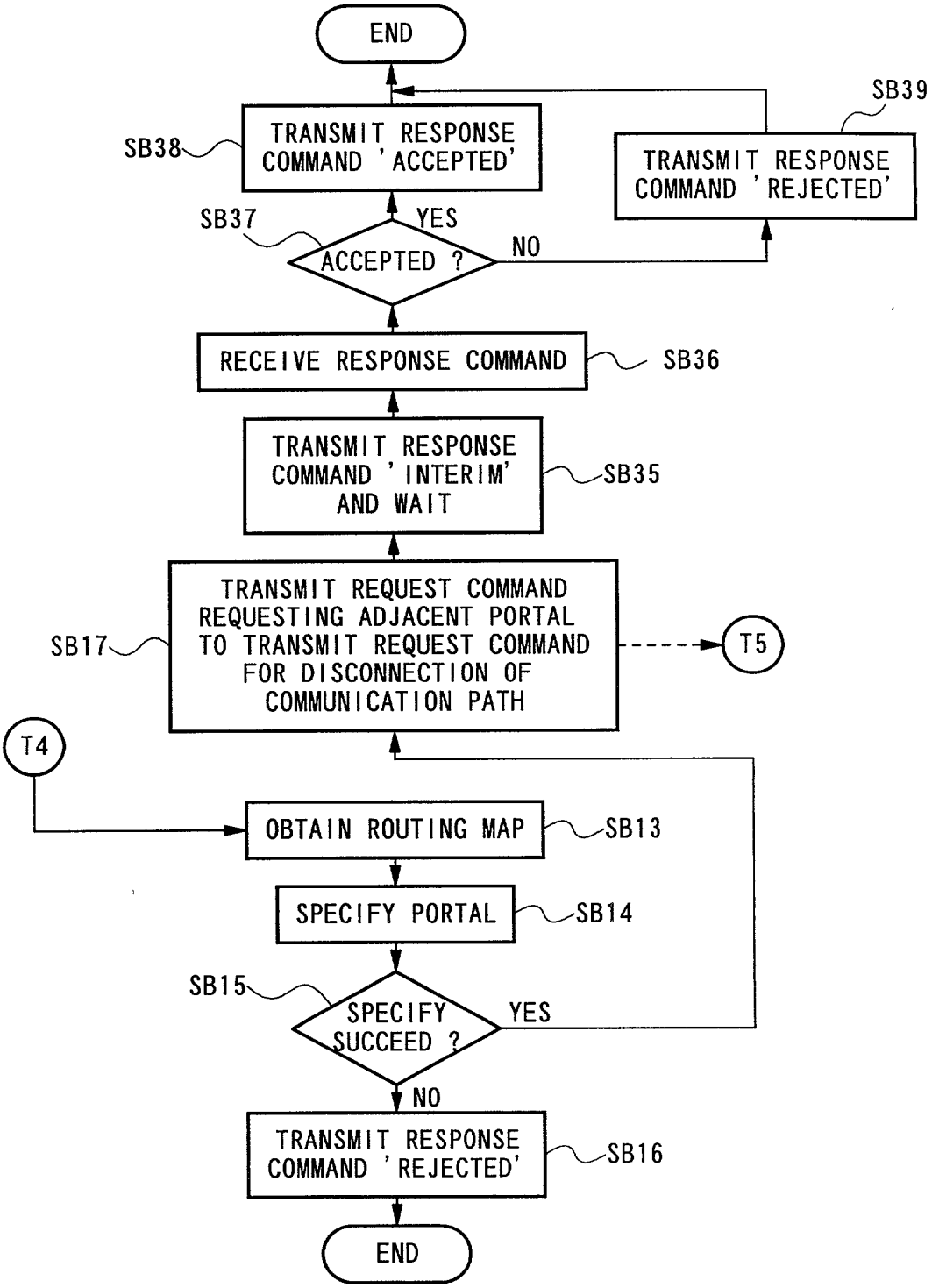
END
SB39
SB38
TRANSMIT RESPONSE COMMAND 'ACCEPTED'
TRANSMIT RESPONSE COMMAND 'REJECTED'
SB37
YES
ACCEPTED ?
NO
RECEIVE RESPONSE COMMAND
SB36
TRANSMIT RESPONSE COMMAND 'INTERIM' AND WAIT
SB35
TRANSMIT REQUEST COMMAND REQUESTING ADJACENT PORTAL TO TRANSMIT REQUEST COMMAND FOR DISCONNECTION OF COMMUNICATION PATH
SB17
T5
T4
OBTAIN ROUTING MAP
SB13
SPECIFY PORTAL
SB14
SB15
SPECIFY SUCCEED ?
YES
NO
TRANSMIT RESPONSE COMMAND 'REJECTED'
SB16
END

FIG. 13

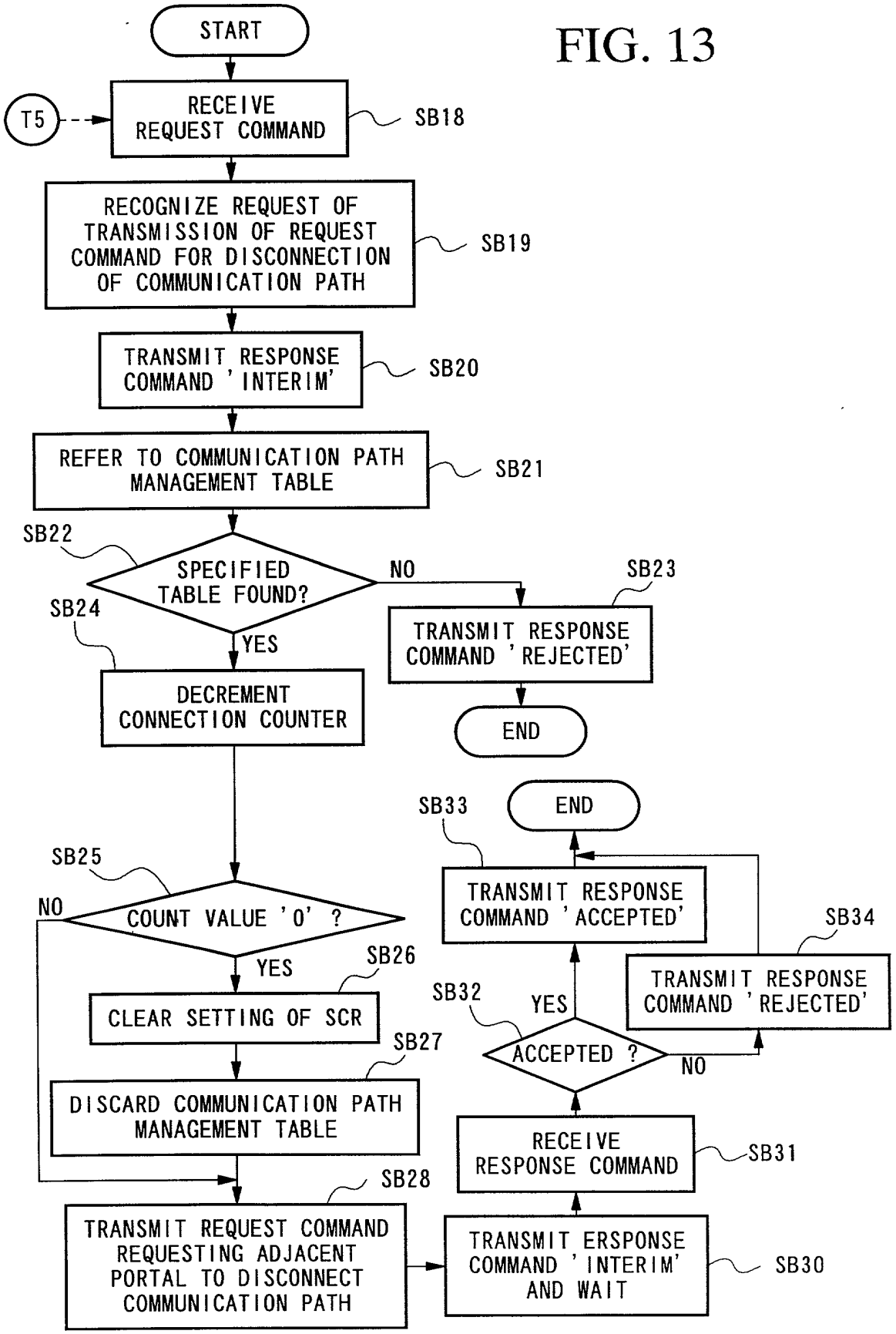
START
T5
RECEIVE REQUEST COMMAND
SB18
RECOGNIZE REQUEST OF TRANSMISSION OF REQUEST COMMAND FOR DISCONNECTION OF COMMUNICATION PATH
SB19
TRANSMIT RESPONSE COMMAND 'INTERIM'
SB20
REFER TO COMMUNICATION PATH MANAGEMENT TABLE
SB21
SB22
SPECIFIED TABLE FOUND?
NO
SB23
TRANSMIT RESPONSE COMMAND 'REJECTED'
END
YES
SB24
DECREMENT CONNECTION COUNTER
SB25
NO
COUNT VALUE '0' ?
YES
SB26
CLEAR SETTING OF SCR
SB27
DISCARD COMMUNICATION PATH MANAGEMENT TABLE
SB28
TRANSMIT REQUEST COMMAND REQUESTING ADJACENT PORTAL TO DISCONNECT COMMUNICATION PATH
TRANSMIT ERSPONSE COMMAND 'INTERIM' AND WAIT
SB30
RECEIVE RESPONSE COMMAND
SB31
SB32
YES
ACCEPTED ?
NO
TRANSMIT RESPONSE COMMAND 'REJECTED'
SB34
TRANSMIT RESPONSE COMMAND 'ACCEPTED'
SB33
END

FIG. 14A

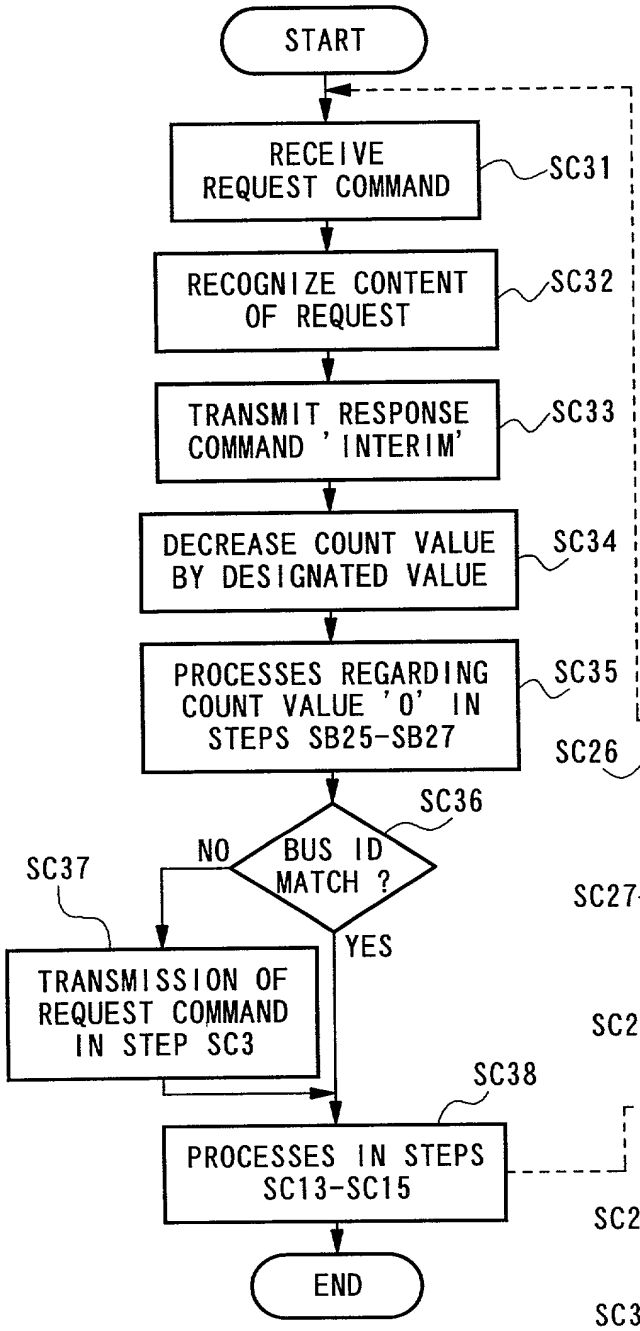

FIG. 14B

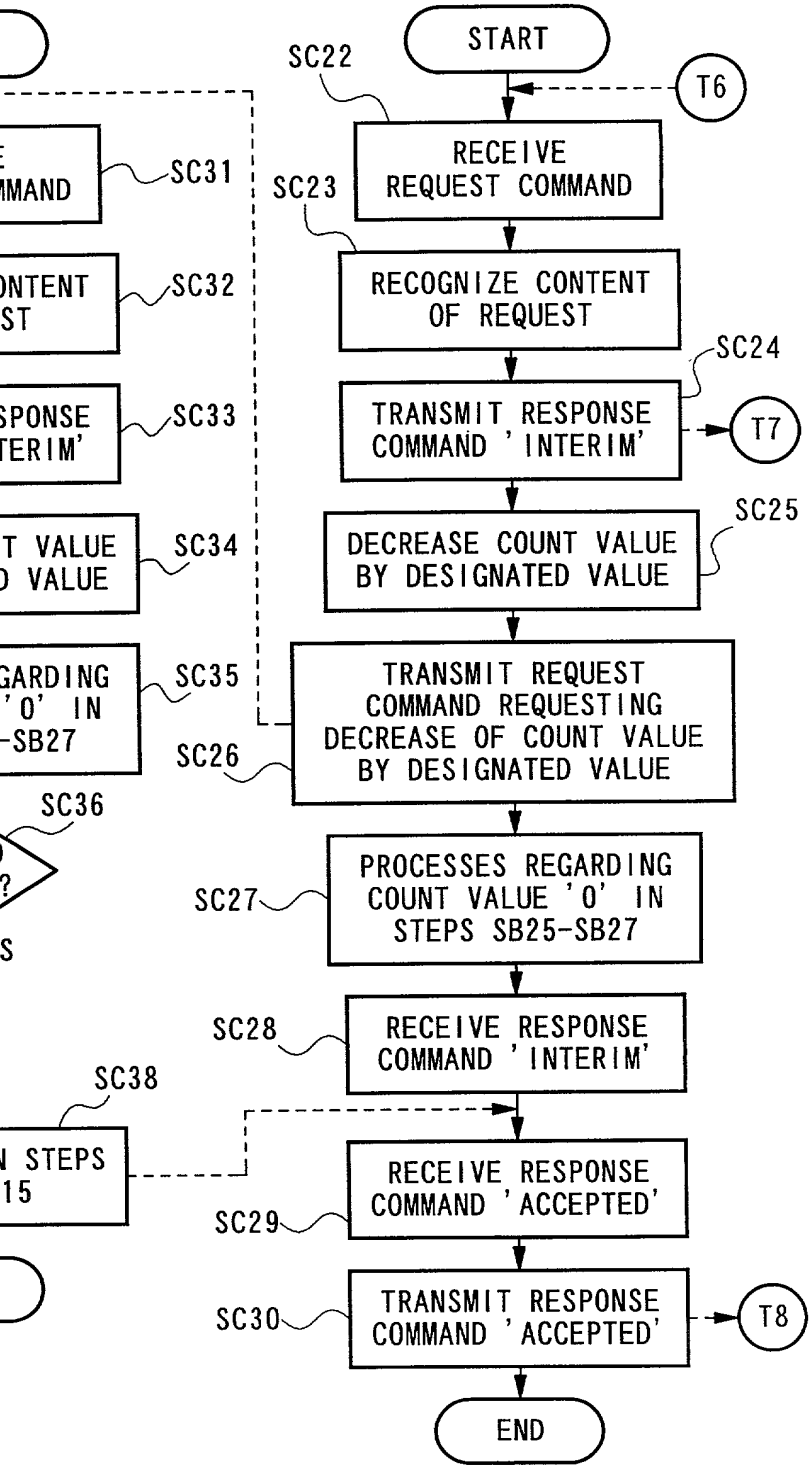

FIG. 15A

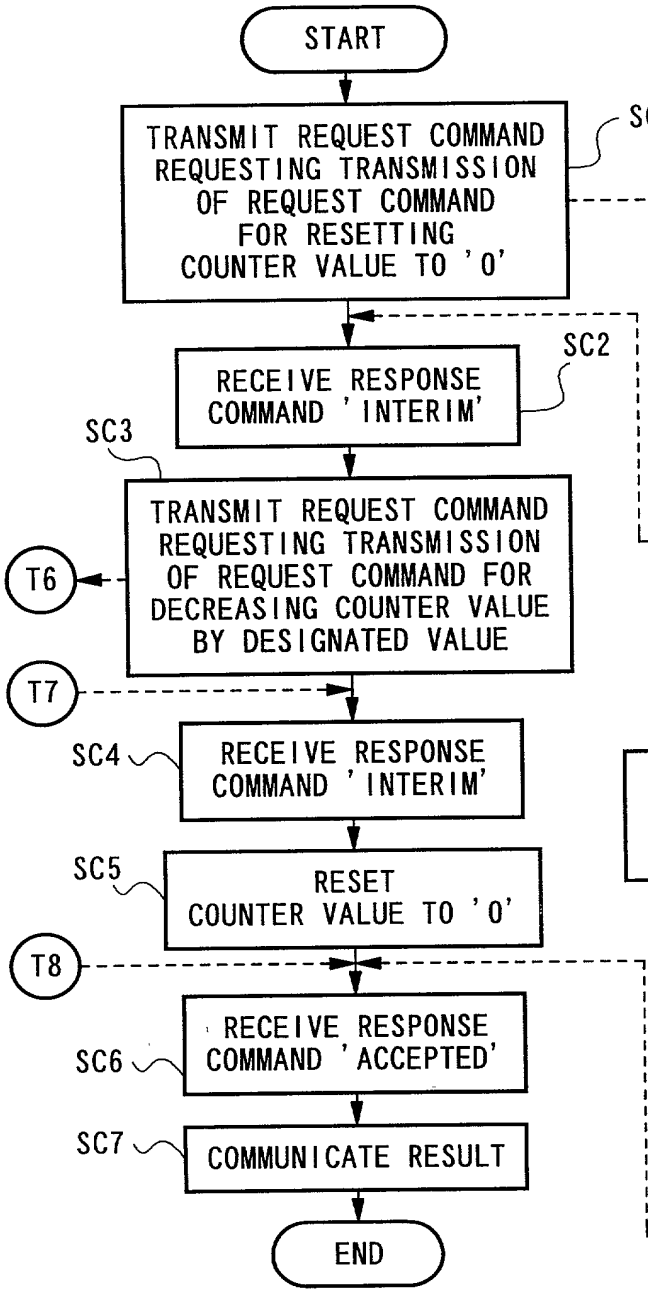

FIG. 15B

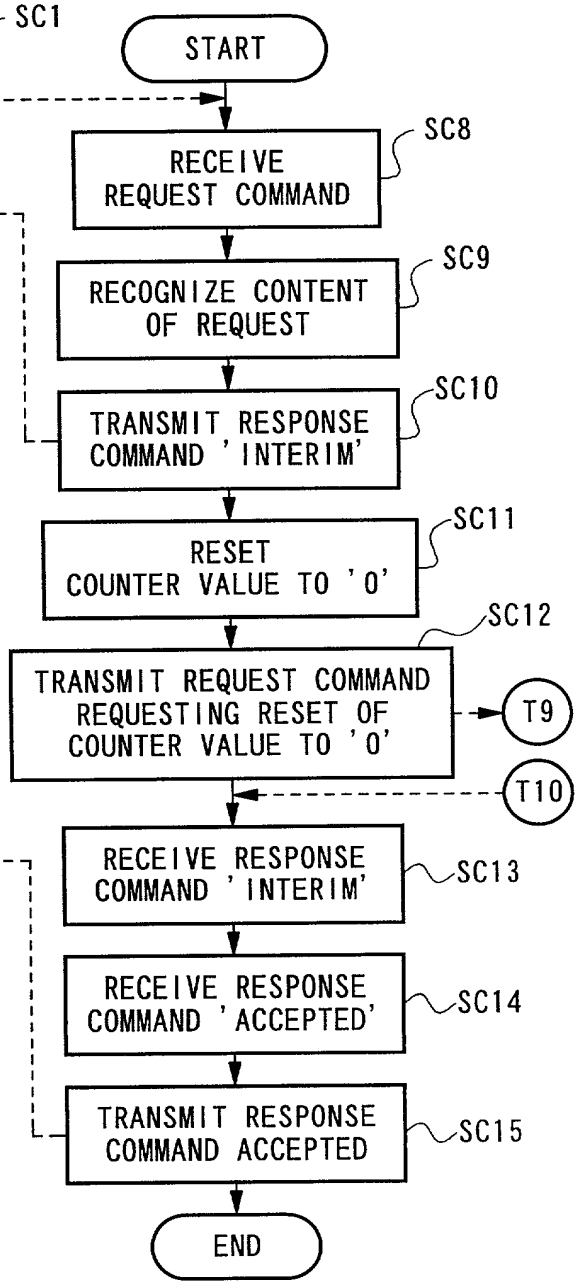

FIG. 16

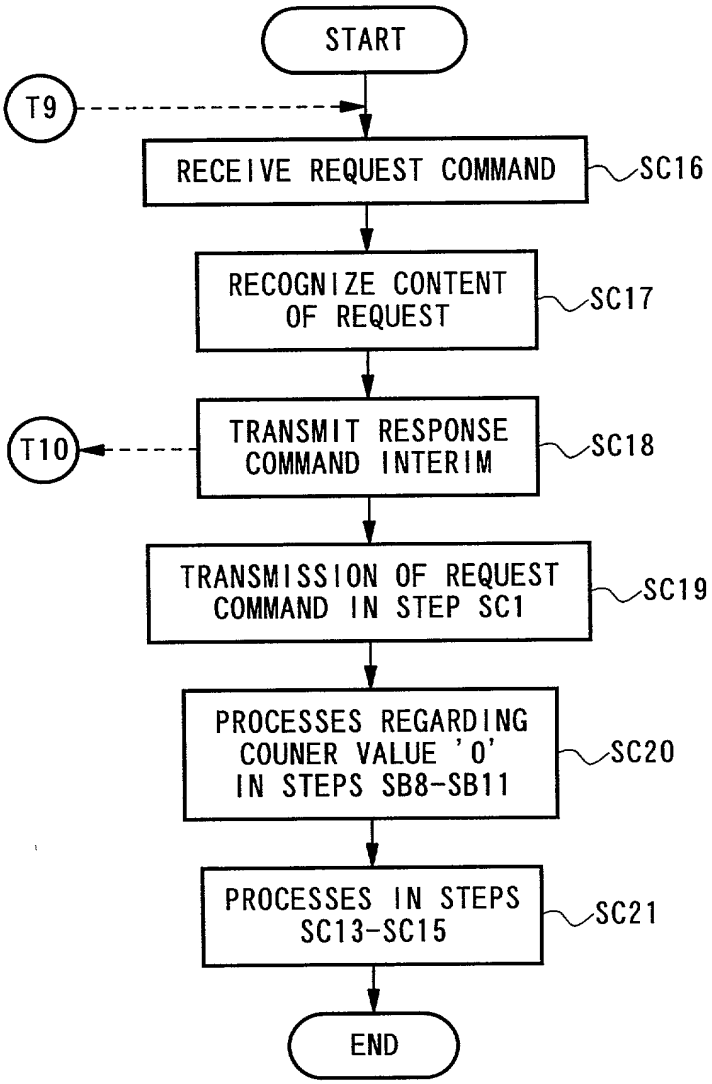
START
T9
RECEIVE REQUEST COMMAND
SC16
RECOGNIZE CONTENT OF REQUEST
SC17
T10
TRANSMIT RESPONSE COMMAND INTERIM
SC18
TRANSMISSION OF REQUEST COMMAND IN STEP SC1
SC19
PROCESSES REGARDING COUNER VALUE '0' IN STEPS SB8-SB11
SC20
PROCESSES IN STEPS SC13-SC15
SC21
END

FIG. 17

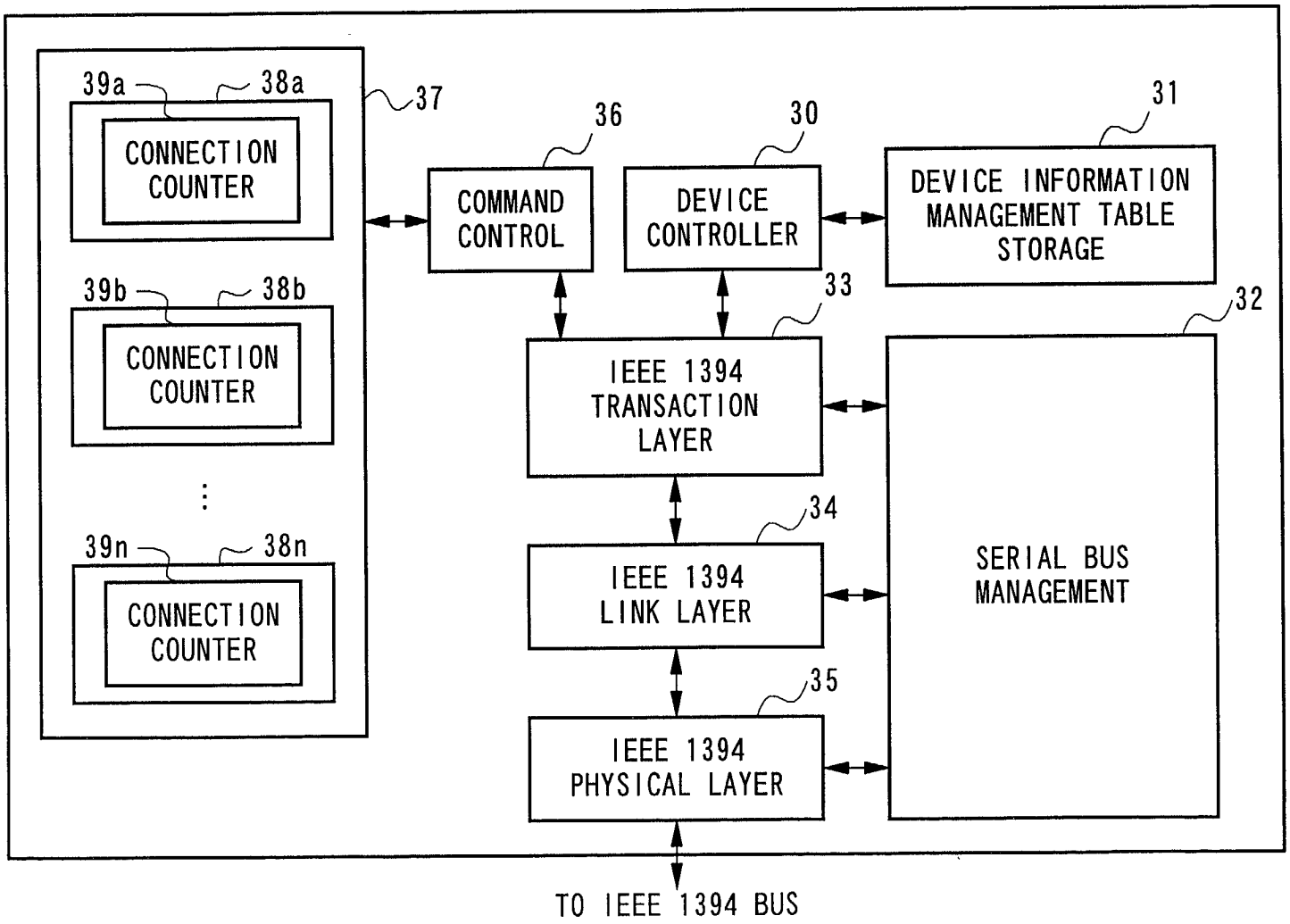
39a
38a
37
CONNECTION COUNTER
36
30
31
COMMAND CONTROL
DEVICE CONTROLLER
DEVICE INFORMATION MANAGEMENT TABLE STORAGE
39b
38b
CONNECTION COUNTER
33
32
IEEE 1394 TRANSACTION LAYER
39n
38n
CONNECTION COUNTER
34
IEEE 1394 LINK LAYER
SERIAL BUS MANAGEMENT
35
IEEE 1394 PHYSICAL LAYER
TO IEEE 1394 BUS

FIG. 18

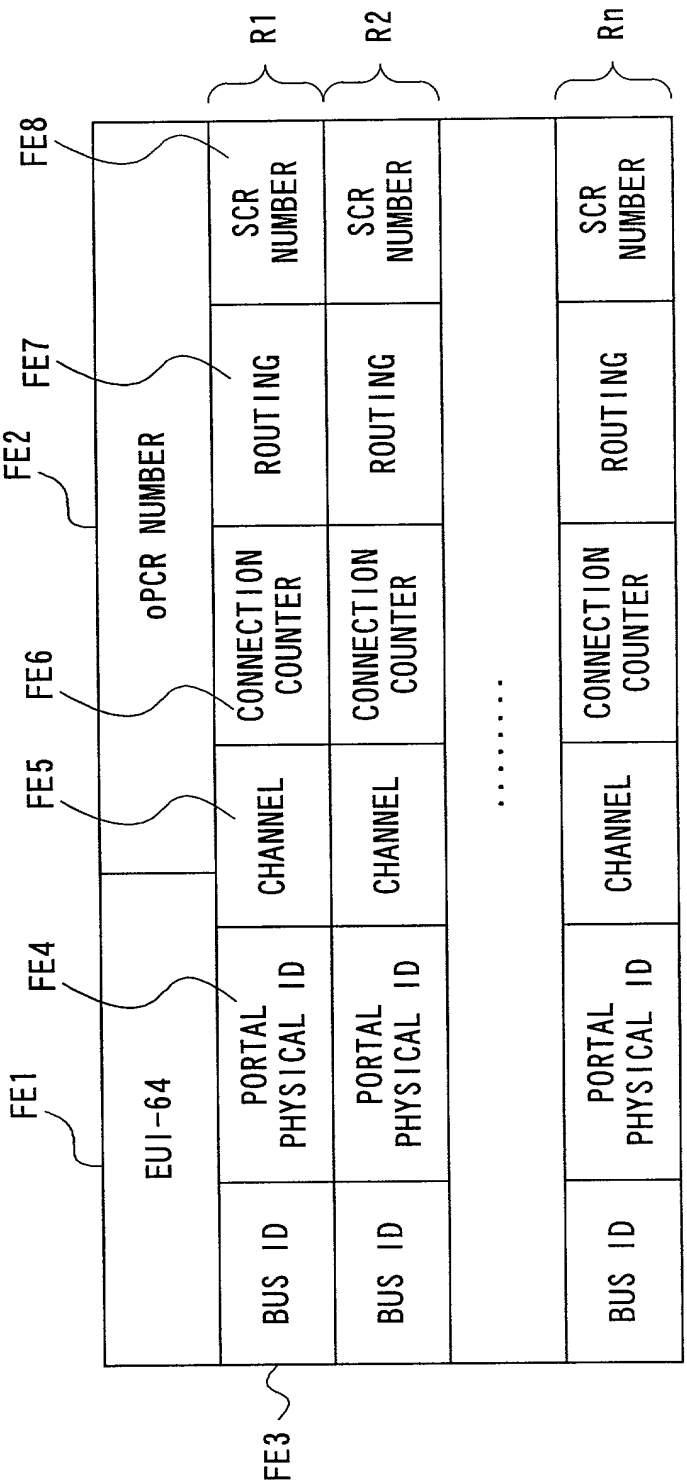
FE1
FE4
FE5
FE6
FE2
FE7
FE8
FE3
EUI-64
oPCR NUMBER
BUS ID
PORTAL PHYSICAL ID
CHANNEL
CONNECTION COUNTER
ROUTING
SCR NUMBER
R1
R2
Rn
.....

FIG. 19

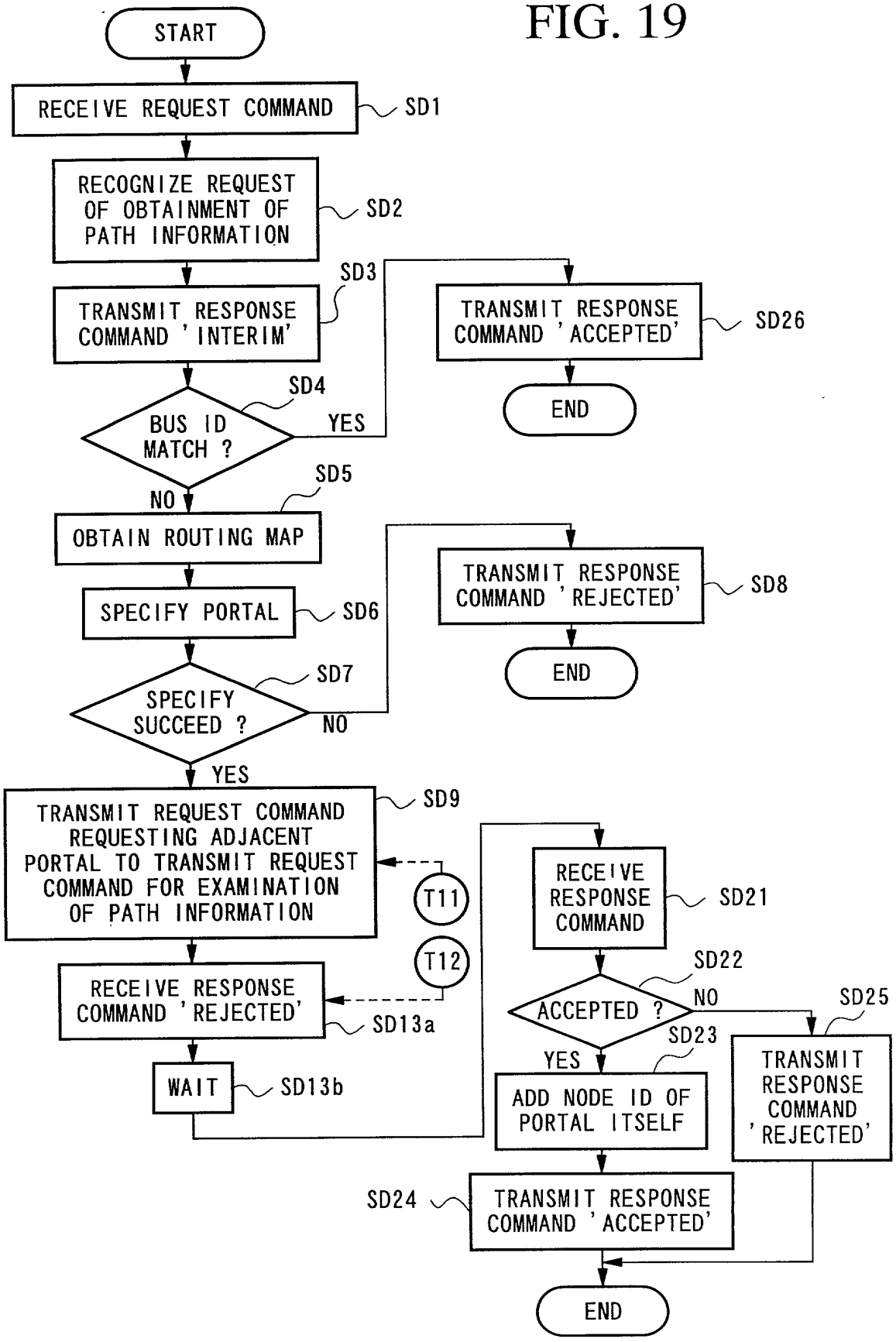
START
RECEIVE REQUEST COMMAND
SD1
RECOGNIZE REQUEST OF OBTAINMENT OF PATH INFORMATION
SD2
TRANSMIT RESPONSE COMMAND 'INTERIM'
SD3
TRANSMIT RESPONSE COMMAND 'ACCEPTED'
SD26
END
SD4
BUS ID MATCH ?
YES
NO
SD5
OBTAIN ROUTING MAP
TRANSMIT RESPONSE COMMAND 'REJECTED'
SD8
END
SPECIFY PORTAL
SD6
SD7
SPECIFY SUCCEED ?
NO
YES
TRANSMIT REQUEST COMMAND REQUESTING ADJACENT PORTAL TO TRANSMIT REQUEST COMMAND FOR EXAMINATION OF PATH INFORMATION
SD9
T11
T12
RECEIVE RESPONSE COMMAND 'REJECTED'
SD13a
WAIT
SD13b
RECEIVE RESPONSE COMMAND
SD21
SD22
ACCEPTED ?
NO
SD25
YES
SD23
ADD NODE ID OF PORTAL ITSELF
TRANSMIT RESPONSE COMMAND 'REJECTED'
SD24
TRANSMIT RESPONSE COMMAND 'ACCEPTED'
END

FIG. 20

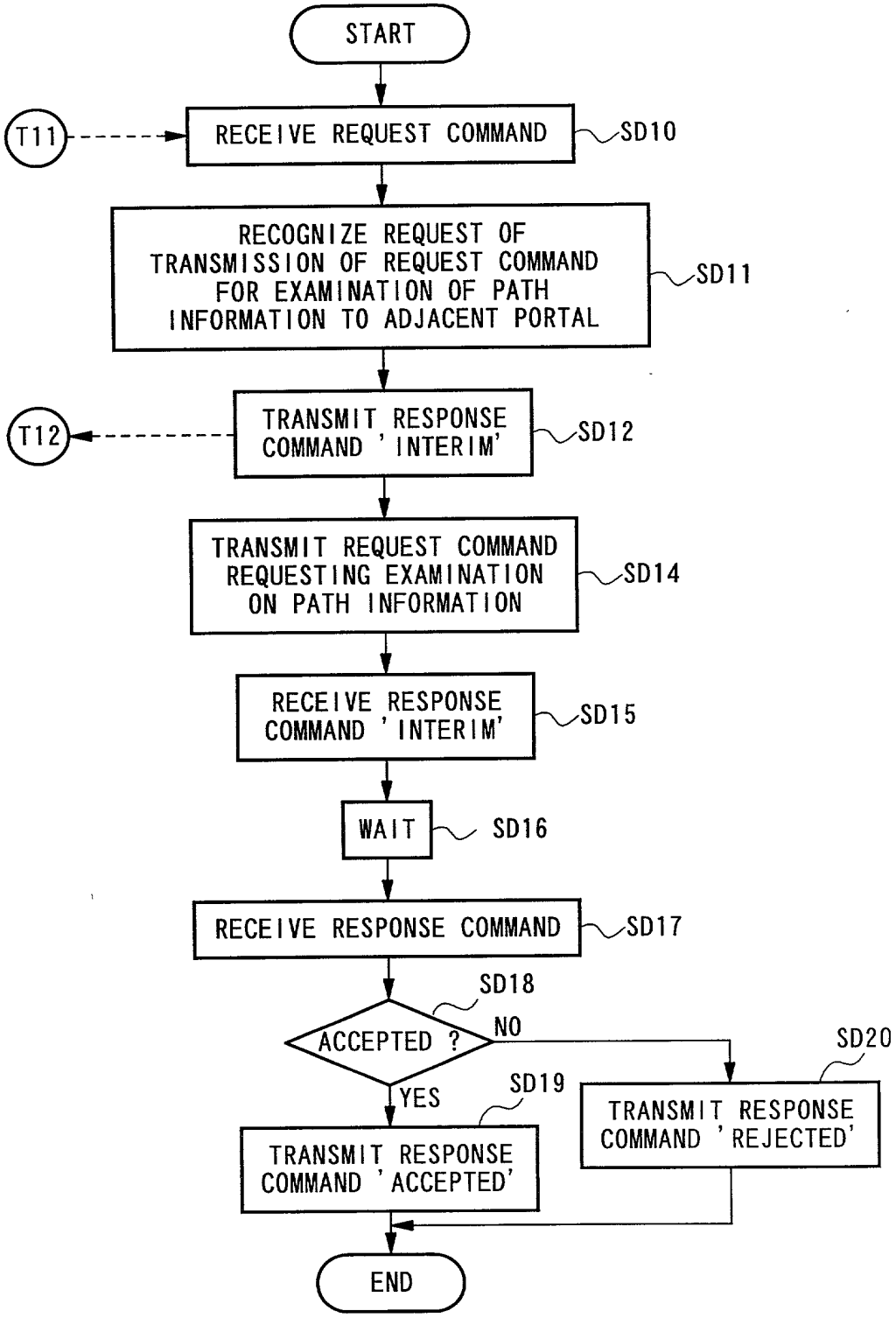
START
T11
RECEIVE REQUEST COMMAND
SD10
RECOGNIZE REQUEST OF TRANSMISSION OF REQUEST COMMAND FOR EXAMINATION OF PATH INFORMATION TO ADJACENT PORTAL
SD11
T12
TRANSMIT RESPONSE COMMAND 'INTERIM'
SD12
TRANSMIT REQUEST COMMAND REQUESTING EXAMINATION ON PATH INFORMATION
SD14
RECEIVE RESPONSE COMMAND 'INTERIM'
SD15
WAIT
SD16
RECEIVE RESPONSE COMMAND
SD17
SD18
ACCEPTED ?
NO
SD20
YES
SD19
TRANSMIT RESPONSE COMMAND 'ACCEPTED'
TRANSMIT RESPONSE COMMAND 'REJECTED'
END

FIG. 21

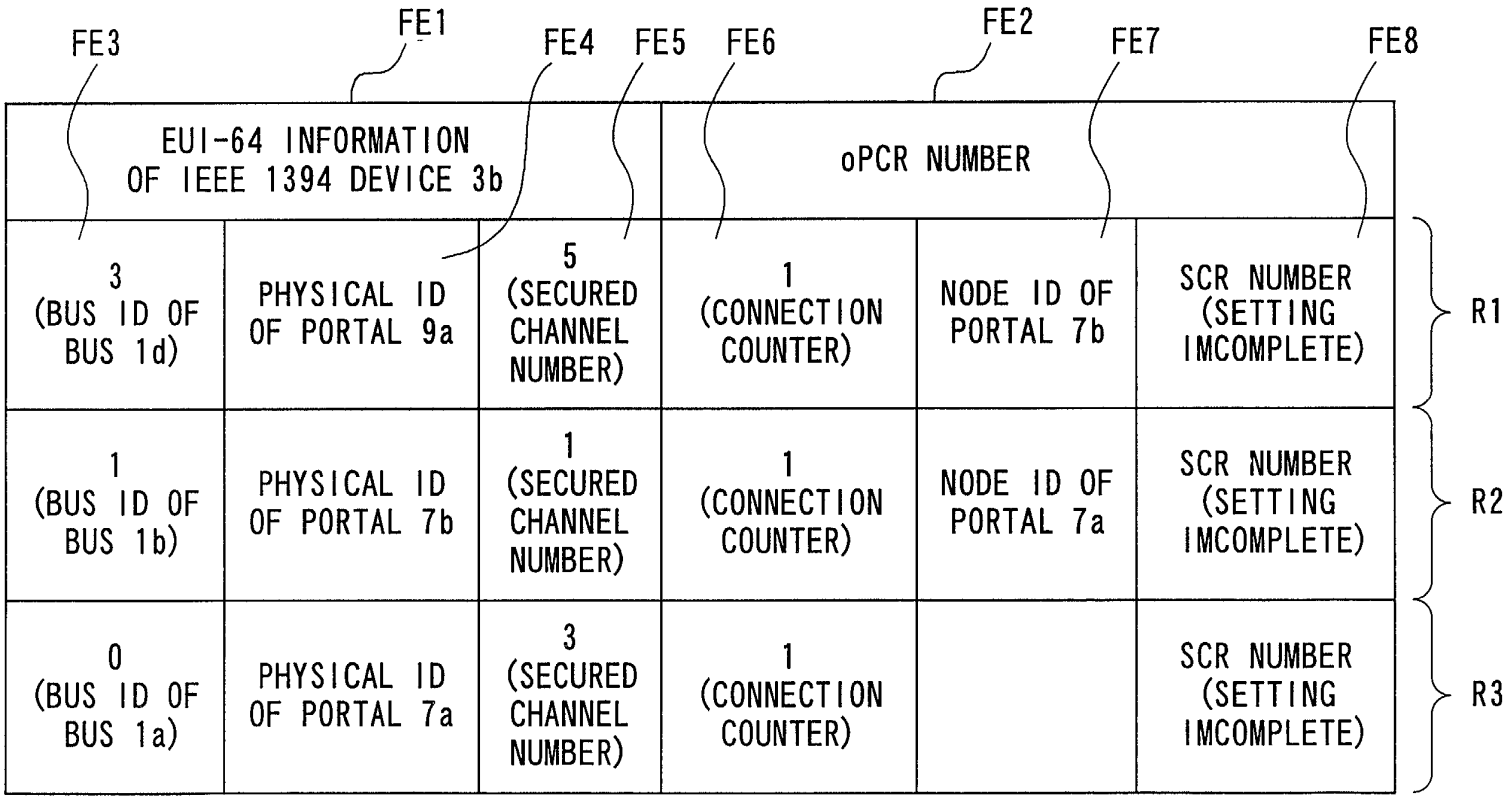
FE3
FE1
FE4
FE5
FE6
FE2
FE7
FE8
EUI-64 INFORMATION OF IEEE 1394 DEVICE 3b
oPCR NUMBER
3 (BUS ID OF BUS 1d)
PHYSICAL ID OF PORTAL 9a
5 (SECURED CHANNEL NUMBER)
1 (CONNECTION COUNTER)
NODE ID OF PORTAL 7b
SCR NUMBER (SETTING IMCOMPLETE)
R1
1 (BUS ID OF BUS 1b)
PHYSICAL ID OF PORTAL 7b
1 (SECURED CHANNEL NUMBER)
1 (CONNECTION COUNTER)
NODE ID OF PORTAL 7a
SCR NUMBER (SETTING IMCOMPLETE)
R2
0 (BUS ID OF BUS 1a)
PHYSICAL ID OF PORTAL 7a
3 (SECURED CHANNEL NUMBER)
1 (CONNECTION COUNTER)
SCR NUMBER (SETTING IMCOMPLETE)
R3

FIG. 22

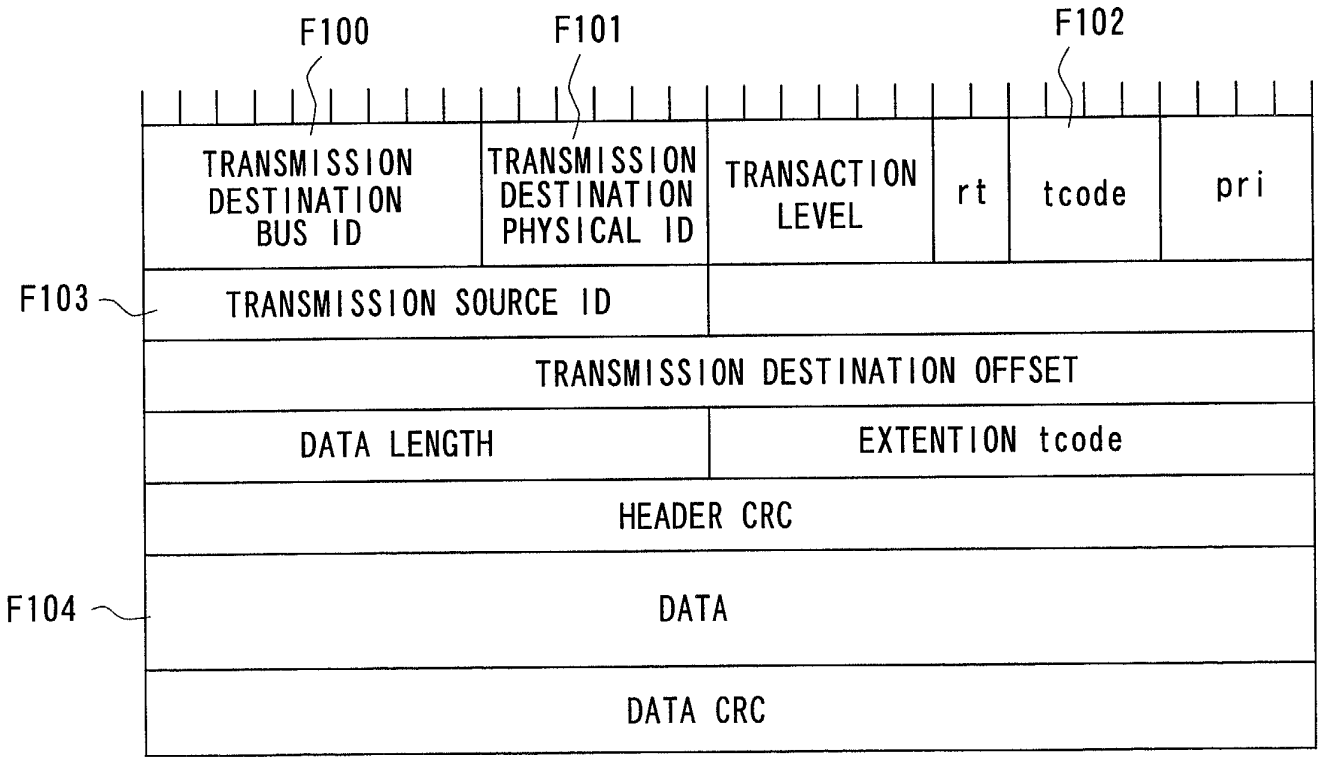
F100
F101
F102
TRANSMISSION DESTINATION BUS ID
TRANSMISSION DESTINATION PHYSICAL ID
TRANSACTION LEVEL
rt
tcode
pri
F103
TRANSMISSION SOURCE ID
TRANSMISSION DESTINATION OFFSET
DATA LENGTH
EXTENTION tcode
HEADER CRC
F104
DATA
DATA CRC

FIG. 23

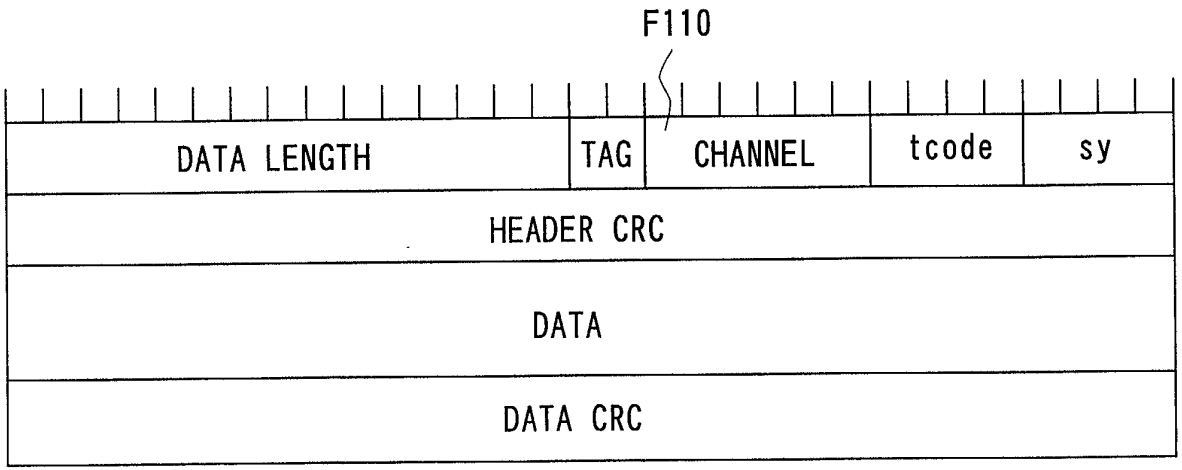
F110
DATA LENGTH
TAG
CHANNEL
tcode
sy
HEADER CRC
DATA
DATA CRC

FIG. 24

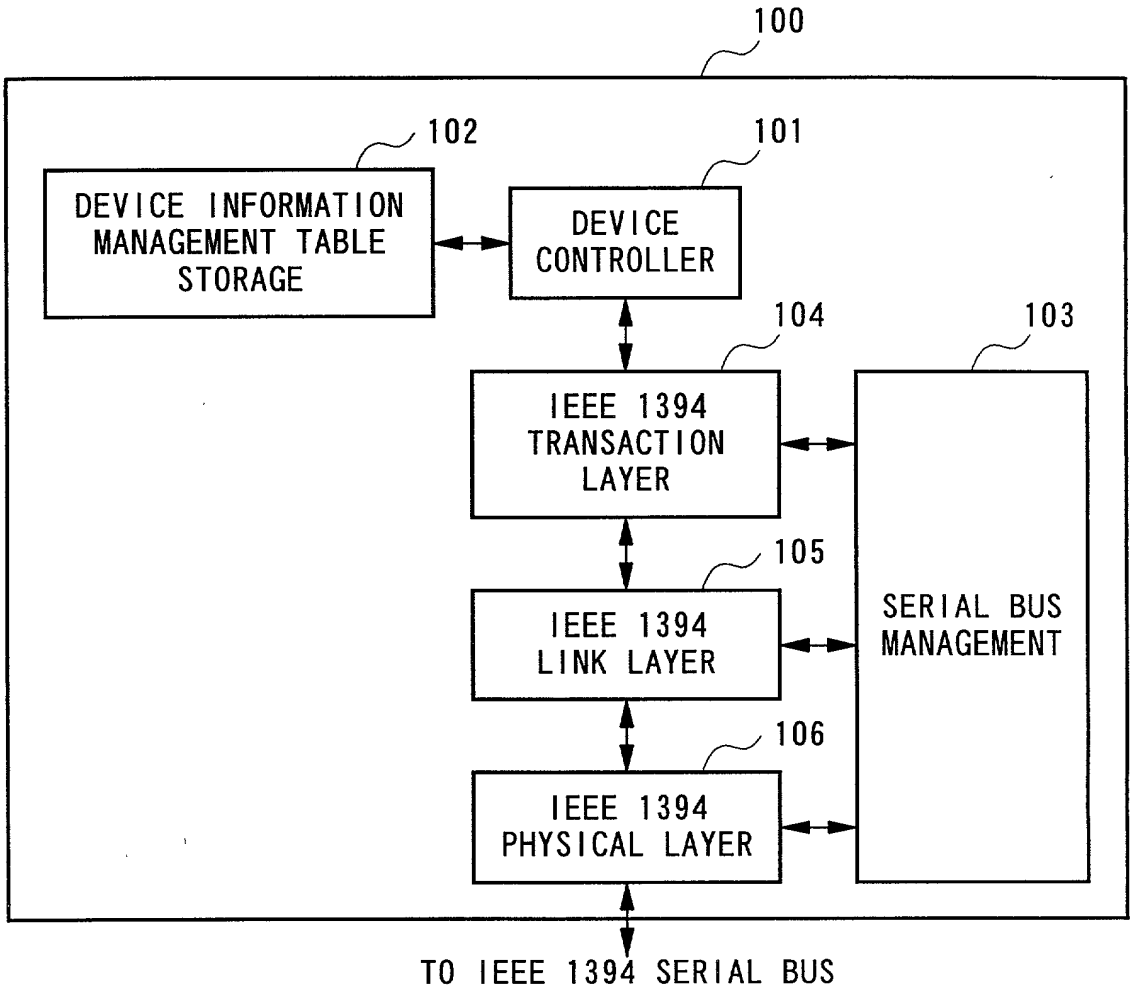
100
102
101
DEVICE INFORMATION MANAGEMENT TABLE STORAGE
DEVICE CONTROLLER
104
103
IEEE 1394 TRANSACTION LAYER
105
IEEE 1394 LINK LAYER
SERIAL BUS MANAGEMENT
106
IEEE 1394 PHYSICAL LAYER
TO IEEE 1394 SERIAL BUS

FIG. 25A

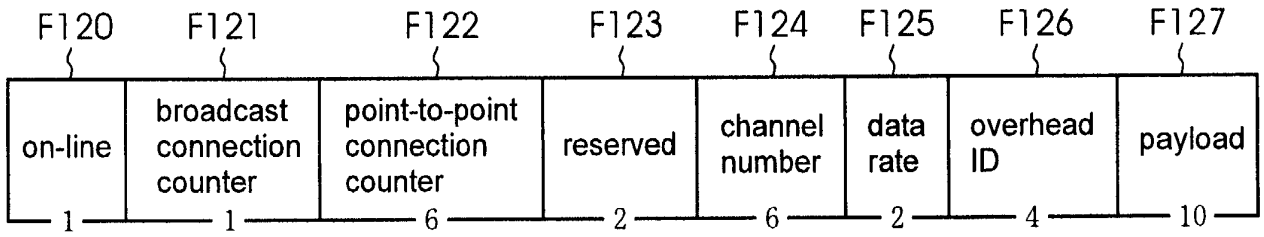

FIG. 25B

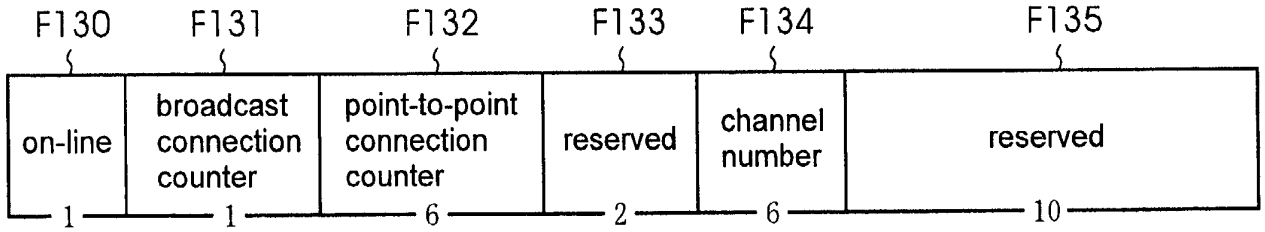

FIG. 26

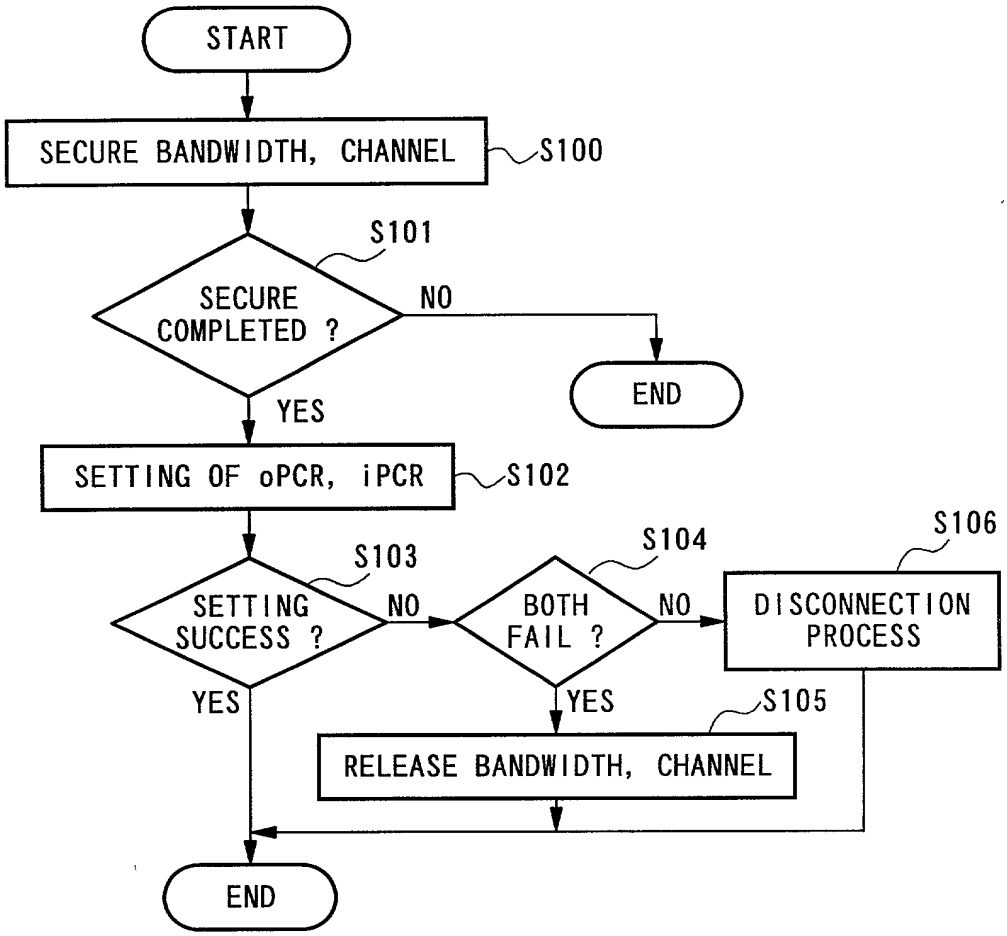
START
SECURE BANDWIDTH, CHANNEL
S100
S101
SECURE COMPLETED ?
NO
END
YES
SETTING OF oPCR, iPCR
S102
S103
SETTING SUCCESS ?
NO
S104
BOTH FAIL ?
NO
S106
DISCONNECTION PROCESS
YES
YES
S105
RELEASE BANDWIDTH, CHANNEL
END

FIG. 27

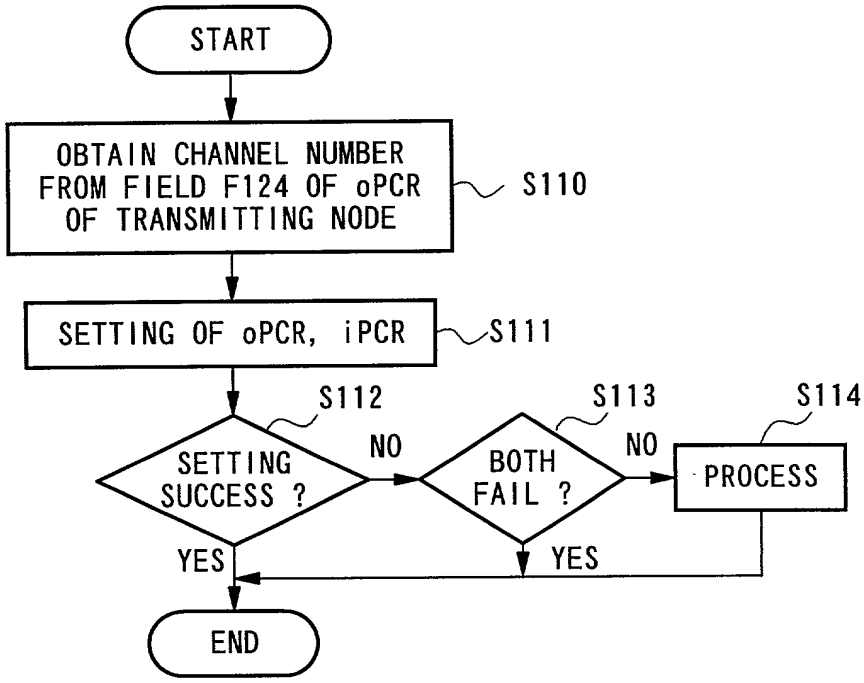
START
OBTAIN CHANNEL NUMBER FROM FIELD F124 OF oPCR OF TRANSMITTING NODE
S110
SETTING OF oPCR, iPCR
S111
S112
SETTING SUCCESS ?
NO
S113
BOTH FAIL ?
NO
S114
PROCESS
YES
YES
END

FIG. 28

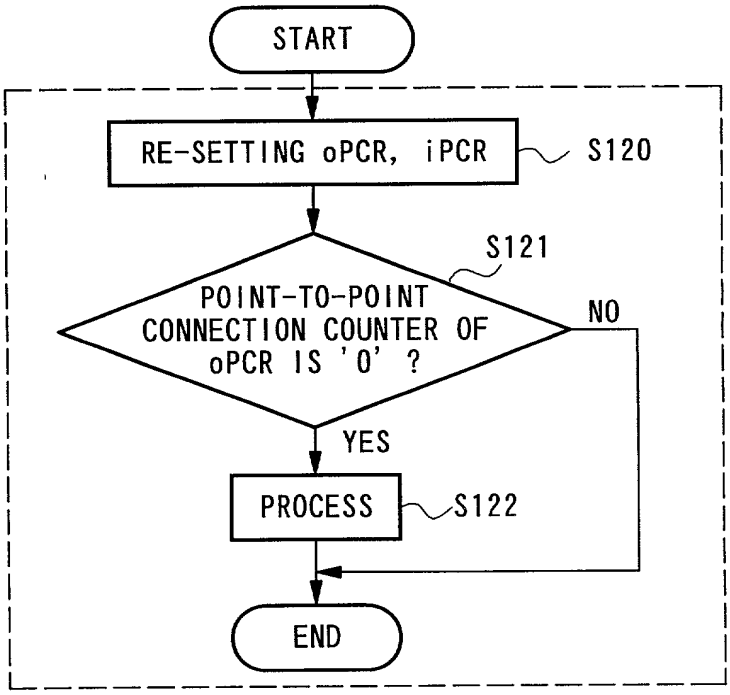
START
RE-SETTING oPCR, iPCR
S120
S121
POINT-TO-POINT CONNECTION COUNTER OF oPCR IS '0' ?
NO
YES
PROCESS
S122
END

FIG. 29

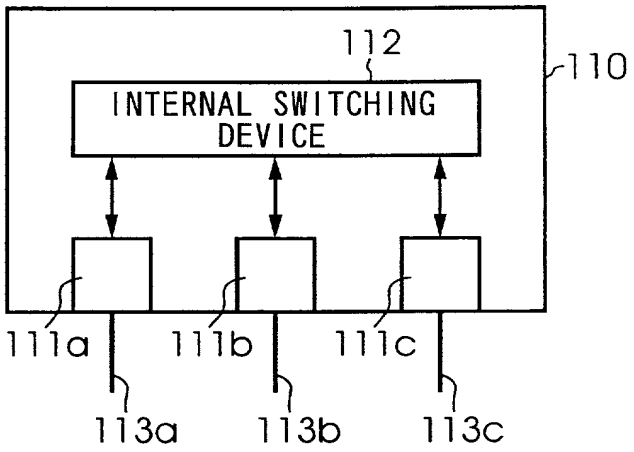

FIG. 30

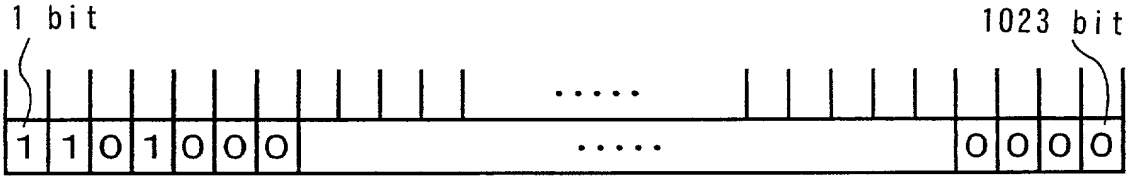
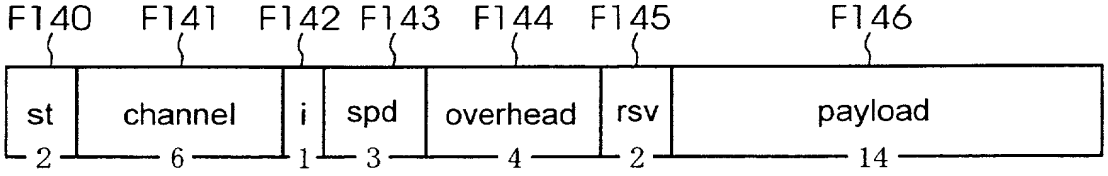
FIG. 31